MACHINERY

Design—Construction—Operation

Volume 46 NOVEMBER, 1939 Number 3

PRINCIPAL ARTICLES IN THIS NUMBER

FOR COMPLETE CLASSIFIED CONTENTS, SEE PAGE 234-B

Design of Universal Drill Jigs.....*By Joseph I. Karash* 161

Broaching Inside Diameter of Large Ring Gears..... 168

Picatinny Advances the Art of Making Ammunition
By Colonel Edward M. Shinkle 172

Up-to-Date Heat-Treating Practice in the National Acme Plant
By William Hogg 174

Editorial Comment 178
Three Ways by which Employment is Made Possible

New Hydraulic System Developed for a Small Grinder
By R. E. Price and F. A. Firnhaber 182

Special Methods in a Jobbing Crankshaft and Camshaft Shop 185

Gear Manufacturers Discuss the Problems of Their Industry.. 193

Some of the Exhibits at the National Metal Exposition..... 194

Condensed Review of Some Recently Developed Materials.... 196

Tocco Hardening Adopted for Jacobs Chucks..... 202

Machine Tool Builders Hold Annual Meeting..... 204

Colonel Norman S. Ramsey, in the leading article in December MACHINERY, will deal with the importance of modern shop equipment in building our mechanized ordnance. Other articles of interest will describe the production of heavy machine members by flame-cutting; sheet-metal operations in an airplane plant; the design of universal drill jigs; and European thread-grinding practice.

DEPARTMENTS

Engineering News Flashes 176

Ingenious Mechanical Movements 179

Design of Tools and Fixtures 189

New Trade Literature..... 206

Shop Equipment News..... 209

News of the Industry..... 234

Product Index 143-158

Advertisers Index 161-162

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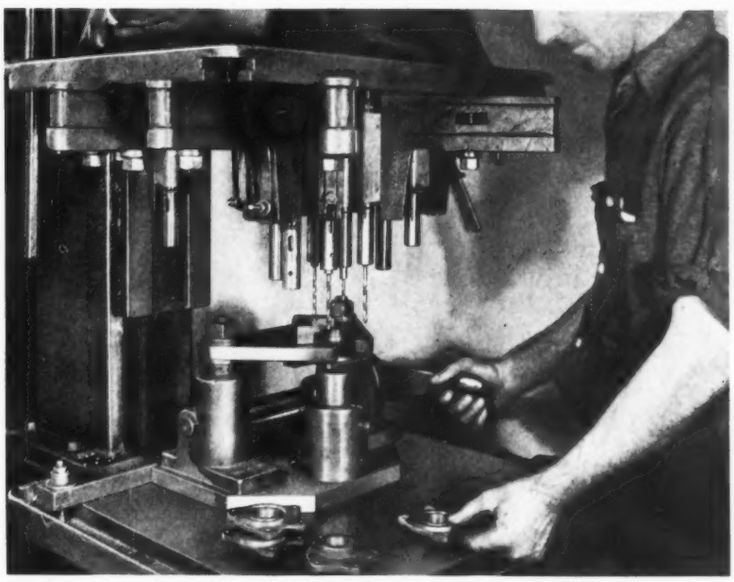
Design of Universal Drill Jigs



A Detailed Review of the Factors to be Considered in Designing Drill Jigs that Combine Economy with Operating Efficiency—First of Two Articles

By JOSEPH I. KARASH, Tool Design Department
Reliance Electric & Engineering Co.
Cleveland, Ohio

IN the design of drill jigs, the main points to be considered by the designer are speed of operation, accuracy, tool cost, and interchangeability. These points are more or less opposed to one another; that is, if the designer stresses speed of operation, he may have to compromise on the other factors. In considering a design, the designer more or less subconsciously weighs the various factors against one another and decides upon a solution that seems to produce a happy medium. The solution, however, may be influenced to some extent by prevailing business conditions, shop facilities, etc. Therefore, the designer's viewpoint may vary from day to day, and the designs may not conform to any one line of reasoning.

Granted that the factors are extremely variable, it is possible to so analyze them as to find a definite governing principle. A procedure may thus be established that will make it unnecessary to go over all the factors involved every time a drill jig is to be designed. Jigs designed according to such a procedure will be developed uniformly in conformance with an established tool policy, and in the long run, will make it possible to realize a substantial saving in costs.

The design of the top plates and adapters for so-called "universal" drill jigs is especially adapted to standardization. This article and a subsequent one will be devoted to this subject and an attempt made to deal with fundamentals. Concrete examples will be given in an effort to illustrate the points clearly.

It should be kept in mind that the design procedure suggested here may not apply in every line

of manufacture, just as Ford methods will not apply to a back-alley garage. The main point is, however, that some design procedure *can* be established which will be best suited to a given line of manufacturing.

To make clear the objective of this article, the principal phases of universal jig design will be discussed under the following headings: (1) What are universal drill jigs? (2) Why are they used? (3) Where are they used to best advantage? (4) Design practice illustrated by representative examples. (5) Tools for making top plates and adapters.

What Are Universal Drill Jigs?

There are a large number of companies manufacturing universal drill jigs. A typical example of such a jig is shown in the heading illustration and in Fig. 1. In construction and operation, the various makes of jigs are essentially the same. The jigs are universal to the extent that the main body and operating mechanism can be used for a number of operations by changing the bushing plate (top plate) and adapter.

The construction of universal jigs is quite simple. The top plate is secured to two vertical posts. These two posts are raised and lowered through a lever arm, the top plate maintaining a horizontal position at all times. The piece to be drilled is placed under the top plate, on the adapter, and the top plate is then lowered, clamping the work in position. After the drilling operation, the top plate is raised and the work removed, completing the cycle.

There is generally a locking device connected with the lever arm. This device maintains the clamping pressure and prevents the work from shaking loose while being drilled. The main difference between the various makes of universal jigs is in the construction of the locking device.

A typical top-plate blank is shown in Fig. 2. It consists simply of a steel plate with two holes drilled and reamed in it to accommodate the posts of the jig. Plates can be produced cheaply by flame-cutting them out of boiler plate and drilling the post holes in a simple drill jig. Fig. 3 shows a representative adapter blank. A commercial punch-holder—that is, the upper half of a postless die set—makes a satisfactory and inexpensive adapter blank.

The choice of any equipment must be justified on the basis of dollars and cents. The use of universal drill jigs can be justified because of the following advantages: (a) speed of operation; (b) interchangeability; (c) saving in tool cost; (d) saving in design cost; (e) saving in time-study cost. To further clarify these potential advantages, let us analyze each one.

Speed of Operation with Universal Drill Jigs

Speed of operation is the greatest advantage of the universal drill jig. With a properly designed top plate and adapter, this type of jig is fast in operation because, first, it is operated by a simple motion of a lever handle. This eliminates the use of wrenches, C-washers, locking bars, and other work-securing devices that have to be handled.

Second, the operator goes through the same motoins to drill any part. It is a well known fact that if an operator performs a highly repetitive operation day after day, he will involuntarily establish a smoothness of motion which results in increased efficiency. The universal drill jig makes it possible to drill a dissimilar line of parts as if they were all practically alike.

Third, the universal drill jig can be secured to the table of the drill press. This eliminates the necessity of positioning the jig relative to the drills for every drilling operation. In the case of single-purpose drill jigs, it is not possible to se-

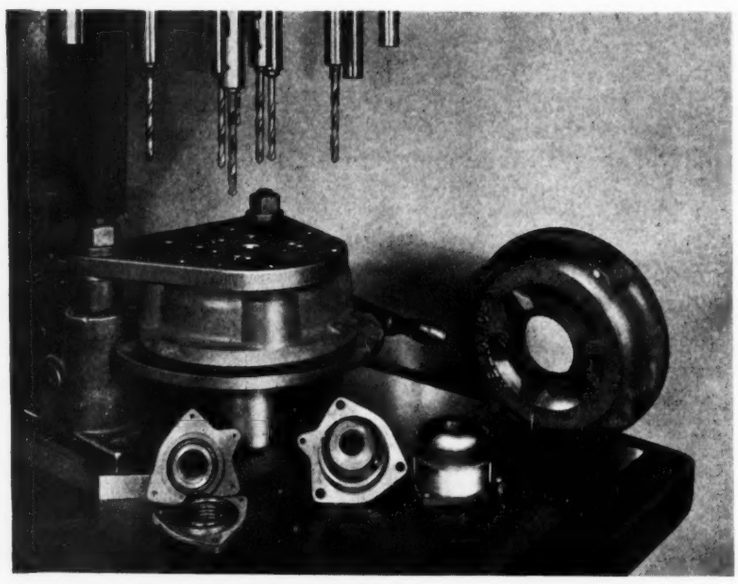


Fig. 1. A Typical Design of a Universal Drill Jig with Top Plate Secured to Two Vertical Posts, the Latter being Raised and Lowered by a Lever, while the Top Plate Remains in a Horizontal Position at All Times

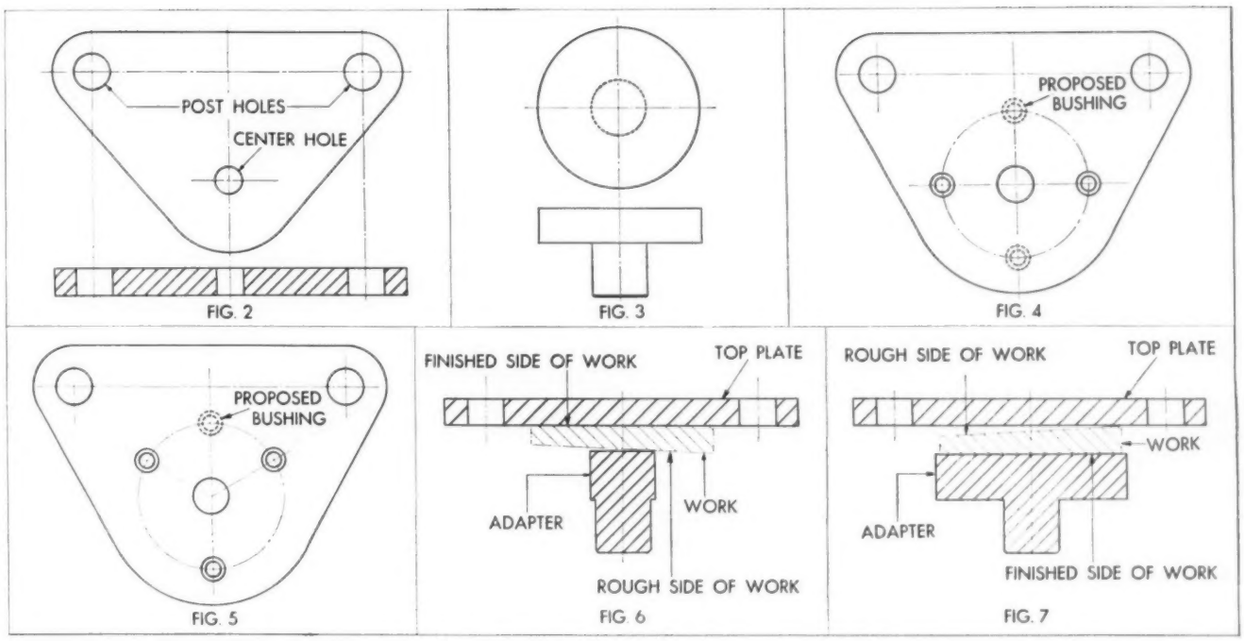


Fig. 2. A Typical Example of a Top-plate Blank. Fig. 3. An Adapter Blank of Common Design. Fig. 4. An Example where Two Holes are Added in an Existing Top Plate. Fig. 5. Adding One Hole to an Existing Jig Plate in Order to Save the Cost of a New Plate. Fig. 6. Method of Design when the Finished Side of the Work Faces the Top Plate. Fig. 7. Design Used when Finished Side of Work Faces the Adapter

cure the drill jig to the drill table, because most jigs of that type have to be handled. The elimination of the need of positioning is particularly advantageous in multiple drilling, because it would be more difficult to position a number of bushings to the drills than it is to position just one.

An indirect advantage of securing the universal drill jig to the table is that the drills will enter the bushings practically without touching. This results in longer drill and bushing life. With single-purpose drill jigs, which must be positioned relative to the drills, there is almost invariably a noticeable chatter as the drills enter the bushings. This dulls the lips of the drill and subjects the bushing to severe wear.

Fourth, in ordinary shop practice where single-purpose drill jigs are used, it will be noted that most of the drill jigs have to be turned over for loading and unloading. The reason for this is that it is easier to turn the jig over, lay the work in the jig, and secure it in place than it would be to reach under the jig and have to hold the work in place while securing it. In the case of the universal drill jig, the work is always laid on the adapter and the bushing plate clamped down on the work. This eliminates the necessity of turning the drill jig over.

Fifth, in most instances, the top plate and the adapter of the universal jig can be so designed that it is unnecessary to clean the chips from the locating surfaces. This important advantage can be realized without sacrificing accuracy. This is not generally true with single-purpose drill jigs. The ways and means of eliminating chip cleaning through proper design will be explained later in this article.

Interchangeability of Universal Drill Jigs

The purpose of interchangeability in drill jigs is, of course, to maintain a minimum tool inventory. The most desirable condition is to have a line of tools that will operate at maximum efficiency, with a minimum investment in dollars and cents. It should be kept in mind that this ideal is not always achieved by having a minimum number of jigs in stock. The smallest possible number of jigs to cover any given line may result in decreased efficiency of operation.

Interchangeability in universal drill jigs is obtained in three ways: First, the main body and operating mechanism can be used with a variety of top plates and adapters. It is generally less expensive to make a top plate and adapter for a universal jig than it is to make a single-purpose drill jig which will be *equivalent* to the universal jig in *speed of operation.*

Second, a top plate can be used for drilling more than one part by changing the work locators. In case the work locator must be made an integral part of the top plate, and therefore is not removable, the top plate can be turned over and the other side used. This turning over of the top plate is made possible by the use of headless drill bush-

ings. The purpose of the head on the ordinary drill bushing is to prevent the drill from pushing the drill bushing through the bushing plate. In the universal jig, this is avoided by securing the drill jig to the drill-press table, so as to align the drills and bushings perfectly. This aspect of interchangeability can be best attained if the design is made with this objective in mind. Fig. 4 gives an idea of the range that can be covered by a top plate by simply changing work locators.

The third possibility of providing interchangeability in the top plate is in the addition of more bushings or in using only a few of the bushings in the plate. This phase of interchangeability can easily be overdone. There are disadvantages which may be incurred by having each plate perforated with bushings, so that it resembles a Swiss cheese.

An analysis of the cost of making top plates will generally show that the greatest item of expense is the precision-boring of the holes to hold the drill bushings. The cost of the material for the top plate is a minor consideration. The ideal is to have the smallest number of precision-bored holes possible to cover any given line of parts without handicapping the efficiency of any one operation.

As an illustration, suppose there is a top plate in stock that has two holes bushed for a 3/8-inch drill, spaced 6 inches apart. A new top plate is required for four holes of the same size, equally spaced on a 6-inch bolt circle. In this case, one would add two holes to the plate and save the cost of precision-boring and bushing the other two holes. (See Fig. 4.)

In another case, we may save the boring of one hole. Suppose there is a top plate in stock which has three equally spaced bushings on a 6-inch bolt circle. A jig is required with two bushed holes of the same drill size, spaced 6 inches apart. One hole could be bored and the cost of boring and bushing the other saved. (See Fig. 5.) This clearly illustrates the possibility of interchangeability.

Tool and Design Costs Saved by Using Universal Drill Jigs

Top plates for universal drill jigs are similar to a certain extent. Because of this similarity, an inexpensive drill jig and a boring fixture can be made which will greatly facilitate the producing of top plates. In this way, it is possible to tool up to make tools. Almost every manufacturing plant is continually producing new drill jigs. By using the tools suggested later in this article, the top plates can be made efficiently. This saving would not generally be possible in the case of single-purpose drill jigs.

The cost of designing top plates and adapters for universal drill jigs should not be so great as that of single-purpose jigs because of (1) standardization of design; (2) standardization of tool drawings; and (3) easy check on interchangeability.

Standardization of design has already been referred to. Standardization of tool drawings enables all superfluous details to be omitted in a tool drawing for universal drill jigs. This is possible because of the similarity of all top plates. The only details necessary are those of bushing size and location, and position of work locators.

The checking up of all existing single-purpose jigs before designing a new jig is a discouraging job. In the case of universal drill jigs, a master sheet showing the number of bushings, size, and spacing will make such checking a matter of only a few moments. A chart of this nature would not function for single-purpose drill jigs, because the mechanical construction of single-purpose jigs allows little interchangeability.

Savings in Time-Study Cost

An indirect advantage of universal drill jigs is that there is a possible saving in time-study costs. In the time study of drilling operations, there are two main factors—handling time and drilling time. The actual drilling time in almost any case can be accurately calculated, knowing the size of the hole, depth, and the material to be drilled. It is the handling time on single-purpose tools, which cannot be accurately estimated, that necessitates individual time studies.

In the case of universal drill jigs, the operator goes through practically the same motions for almost any piece to be drilled, as previously stated. When universal drill jigs are used, it should be entirely possible to set rates accurately, without individual time studies, by establishing a small chart of handling times and calculating the drilling time.

Where are Universal Drill Jigs Used to Best Advantage?

This subject is one on which it is easy to become confused. At first thought, one would be likely to discuss this point from the standpoint of single or multiple drilling, or interchangeability, or some similar phase of operation. The real answer is quite simple. The ratio between the drilling time and the handling time determines where universal drill jigs can be used to best advantage. In the operation of any drill jig, the actual drilling time is the same. The difference in operation between various types of jigs would be all in the material-handling time.

For example, suppose that, in a given line of manufacturing, small, short holes are being drilled in cast iron. If, by using universal drill jigs, 50 per cent of the handling time can be saved, it may be possible that 30 per cent of the total operation time will be saved, because the drilling time is a comparatively short element. The other extreme is where deep holes in tough material are being drilled. If, by using universal drill jigs, 50 per

cent of the handling time can be saved, only 5 per cent, perhaps, of the total operation time will be saved, because in this case, the actual drilling consumes a greater amount of time, as compared with the total operation time.

As can be seen, the ratio between the handling time and the drilling time is the real issue. This does not mean that the use of universal drill jigs for drilling deep holes in hard materials cannot be justified. The main point is that the use of universal drill jigs for drilling short holes in soft materials pays greater dividends. The speed of handling is the greatest advantage of the universal drill jig, and it is entirely possible that the use of a universal drill jig as a single-purpose tool can be justified, if used for highly repetitive work.

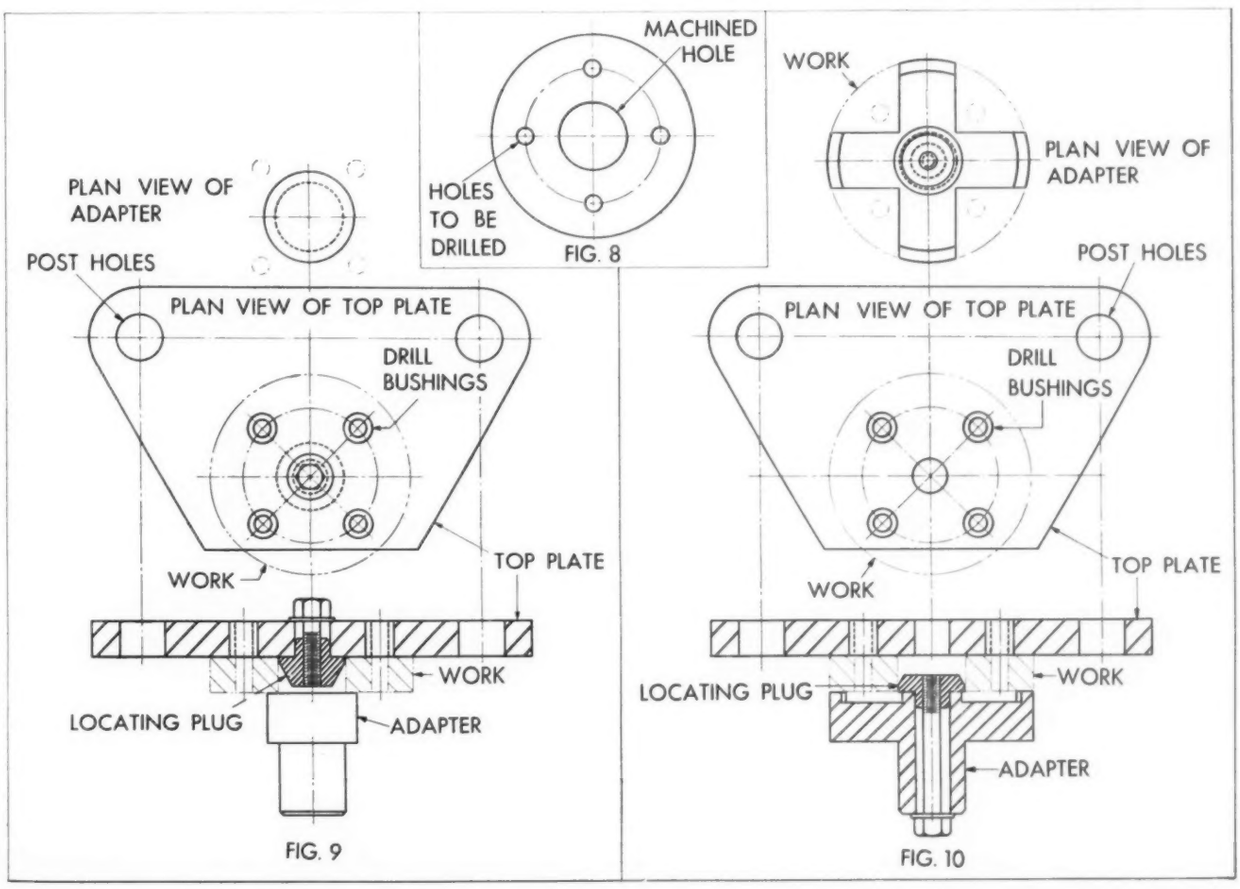
Design Practice as Applied to Universal Jigs

Before going into an explanation of design procedure, it is best to make clear just what factors of the universal jig are not subject to the judgment and decisions of the designer. The mechanical operating characteristics of the universal jig cannot be controlled by the designer. For example, (1) the drill bushings will always be in the top plate; (2) the work is always clamped between the top plate and the adapter through the medium of a lever arm; and (3) the fundamental motions that the operator will go through are already established.

In stating that the mechanical operating characteristics are out of the control of the designer, it should not be assumed that almost any design of top plate and adapter will operate satisfactorily. The few factors that are dependent on the decision of the designer will result in a pronounced effect in the operation of the jig. It should always be kept in mind that a haphazard design of top plate and adapter will not be obviously inefficient until a really efficient design is produced to serve as a contrast.

Now as to the elements that the designer does control. The real issue confronting the designer is: "How shall the work be located?" On this one point hinges all the potential advantages of the universal jig. The method the designer selects to locate the work will affect speed of operation, interchangeability, and tool cost.

Fig. 8. Sample of Work that Requires Internal Concentric Location
Fig. 9. Example of Concentric Location of Work from the Top Plate
Fig. 10. Design of Top Plate and Adapter when Locating from Adapter



The Location of the Work in Universal Drill Jigs

An analysis of the fundamentals of work location will show that there are three principal methods to be considered. They are: (1) establishment of a plane; (2) concentric location; (3) radial location. These terms are rather vague, and require explanation. Each presents a separate problem, and every designing job should be studied with this in mind.

Establishing the plane of the work means to clamp the work in the jig so that the finished face of the work will assume a true horizontal position. At first sight, one might think that any work clamped between the top plate and the adapter would be forced into a horizontal position. However, under certain conditions this is not true.

In order to illustrate this point, assume that there is a piece of work that has only one side surfaced, the machined side, therefore, not being truly parallel with the rough side. It is obvious that, with such a piece of work, both sides cannot assume a bearing in the jig. Unless certain precautions are taken, the drilled holes may not be perpendicular to the finished side of the work. If the holes drilled are to serve as clearance holes, this will probably not matter. However, if the drilled holes are to be tapped, any variation from the perpendicular would be objectionable.

In Fig. 6, is shown the method of establishing a true horizontal plane when the finished side of the work is up. An adapter of small area is used, very little pressure being required to insure the work coming "home" against the top plate. In Fig. 7, is shown the method of establishing a true horizontal position when the finished side of the work is down. An adapter of large area is used; as may be seen from the drawing, no amount of pressure would cause the work to bear fully against the top plate. A simple rule to remember is that, if the finished side of the work is up, a small-area adapter should be used; if the finished side of the work is down, a large-area adapter should be used.

Locating Work Concentrically

By "concentric location" is meant the securing of the work in the jig so that the center hole in the top plate is concentric with a circular edge of the work. This edge can be either internal or external. For example, if a round hole in the work is to serve as the locating means, some sort of machined plug must be provided in the universal jig which will enter the round hole of the work and thus provide a concentric location.

If an external cylindrical surface of the work is to serve as a locating means, some sort of machined surface must be provided in the jig which will fit over the outside of the work and thus provide a concentric location.

In concentric location of work, there are only four possible conditions that can occur: (1) concentric internal location from top plate; (2) concentric internal location from adapter; (3) concentric external location from top plate; and (4) concentric external location from adapter. Some form of concentric location will be required for the majority of work.

Examples are shown to suggest design procedure for each of the four cases of concentric location. A brief discussion will be given with each example. The parts used in these examples are imaginary, having no unnecessary details which might confuse the real issues involved.

When Chip Clearance is Required

In the design examples to be shown, we will consider, for the sake of simplicity, that the work is of cast iron. In drilling cast iron, it is seldom necessary to maintain chip clearance between the drill bushings and the work. The bushing plate can be clamped directly against the face of the work. This, of course, forces the chips to come up through the drill bushings. Such a condition is not objectionable in drilling cast iron, because cast iron chips are a powder and will flow readily up the flutes of the drill. The chips will not ordinarily clog or pack and, therefore, the absence of chip clearance will not slow down the operation.

Another respect in which cast iron differs from other materials with regard to chip clearance is that other materials require coolants, whereas cast iron does not. With metals requiring a coolant for drilling, a liberal clearance between the drill bushings and the work allows the chips to escape from under the drill bushings and permits the coolant to flow freely through the drill bushing down to the cutting edges of the drill. In the design examples to be shown, if chip clearance is desired, it can easily be provided by machining a step on the concentric locator or inserting a bumper button into the top-plate center hole to provide space between the drill bushings and the work.

Case I—Concentric Internal Location from Top Plate

In Fig. 8, is shown a part that requires the drilling of holes on a circle concentric with the finished bore machined in a previous operation. In Fig. 9 is shown a design of top plate and adapter for locating this work concentrically from the top plate. A hardened plug is provided for the top-plate center hole which enters the bored hole in the work.

Plane of Work—It is good practice to use this type of design only when the finished side of the work is in the "up" position. To establish the plane of work, a small-area adapter is used, as stated previously. The land on the locator plug must be quite small to prevent jamming in the work. Unless the locating plug enters all the way into the

work, a true concentric position may not be established.

Chip Disposal—In the design shown, all the locating is done from the top plate. Gravity will tend to prevent chips from clinging to the locating surfaces. The dummy adapter is smaller than the bolt circle, and hence, the chips will fall clear of the adapter. In this particular case, chips on the adapter face cause no trouble, as they will affect neither the plane nor the concentricity of the work.

Locator Lead—In this type of design, as the operator cannot see the locating plug, it is necessary to provide ample "lead" on it. The length of the lead is not limited by the thickness of the work; in the case of thin material, the dummy adapter can be counterbored to allow the locating plug to enter.

Interchangeability—This type of design allows the greatest possibilities for interchangeability. By simply removing the concentric locating plug, the top plate is left entirely free from encumbrance, so that the plate can be used for any other type of work which can be accommodated in the universal jig. This type of design also allows maximum interchangeability of the adapter. The adapter required can be a dummy, and might be considered part of the universal jig itself. This adapter need not be stored in the tool-crib with the top plate, but can be kept at the drilling station with the universal jig, as an auxiliary piece of equipment.

Case II—Concentric Internal Location from Adapter

In Fig. 10 is shown a design of top plate and adapter for concentrically locating the work shown in Fig. 8 from the adapter.

Plane of Work—It is good practice to use this type of design only when the finished side of the work is in the "down" position. A large-area adapter is used to insure the establishment of the plane on the adapter face.

Chip Disposal—Since the adapter is below the drill bushings, it is in the path of the falling chips. There are several things that can be done to help solve the problem of chip disposal: (1) the locating plug support can be made of a smaller diameter than the plug, so that a corner is not formed where chips will gather; (2) the adapter can be cut away below the bushings, so that the chips will fall clear; and (3) the contact edges of the adapter can be made with a small total area. This will minimize the possibility of stray chips gathering on this surface.

Locator Lead—In this type of design, the operator can see the concentric locator when the jig is in the open position. It is only necessary for him to place the work so that the locating plug enters the hole in the work. The closing of the jig will force the work into a true concentric position. It is a disadvantage to have too long a lead on the plug, as the work must be slipped over the locator.

Interchangeability—In this type of design, the top plate is entirely free from encumbrances, and consequently has the greatest possible degree of interchangeability. The adapter is interchangeable to the extent that the locating plug can be changed to suit any other diameter of hole. It is more advantageous to decrease the interchangeability of the adapter than to interfere with the efficiency of the top plate.

In the concluding article of this series, to be published in a coming number of MACHINERY, additional examples of locating methods will be given.

Warren H. McBryde Elected President of the American Society of Mechanical Engineers

WARREN Horton McBryde, consulting engineer and industrialist of San Francisco, Calif., has been elected president of the American Society of Mechanical Engineers for the year 1940. Mr. McBryde was born in Mobile, Ala., in 1876. At the age of seventeen, he entered the Alabama Polytechnic Institute, from which he graduated in 1897. Since that time, he has been engaged in many different branches of engineering. In 1927, he started his present business as consulting engineer.

Mr. McBryde has been a member of the American Society of Mechanical Engineers since 1921. He was chairman of the San Francisco Section in 1925 and 1926. In 1937, he was elected a vice-president of the Society. Mr. McBryde has also been very active in civic matters in the communities in which he has resided. He has been mayor of Hercules, Calif., and supervisor of Contra Costa County, Calif. In 1921, he was president of the Industrial Association of San Francisco. He was one of the founders of the Engineering Societies Employment Service office in San Francisco, and has taken great interest in young engineers.

Broaching Inside Diameter of Large Ring Gears

A BROACHING operation of considerable interest is being performed on large ring gears by a prominent tractor manufacturer. It consists of broaching the internal bore of large steel tractor ring gears, and was developed to increase the accuracy of subsequent manufacturing operations, in which the gear teeth are machined in accurate relationship to the inside diameter finished by the broach.

The machine used for this operation, together with the broaching equipment employed, is shown in Fig. 1. This is a standard open-side Utility press made by the Colonial Broach Co. The machine has a rated capacity of 10 tons, and is hydraulically operated throughout. The gear blank to be broached is located in a fixture mounted on a table which can be raised or lowered in relation to the ram through the provision of cross-keyways in the face of the column.

The broach, shown in Fig. 2, is approximately 15 inches long, and is built up from a number of individual rings, the lower ones being provided with chip-breakers. The operation is of the semi-finishing type, the final finish being obtained by a subsequent machining operation. The broach is almost 2 feet in circumference and is guided at both the top and bottom throughout the working stroke. It is released by the ram at the end of the downward working stroke to permit removal of the broached forging.

An automatic broach-handling device is provided below the fixture table which raises the broach into the puller after the work has been removed and before the ram returns to the top position. The machine is set for a stroke of 24 inches. The cutting speed of 30 feet per minute, with a return speed of 60 feet per minute, gives a high production rate.

* * *

Westinghouse Semi-Industrial Movie

A motion picture with a purpose, "The Middleton Family at the New York World's Fair," has been produced for the Westinghouse Electric & Mfg. Co. by Audio Productions, Inc. Beneath the surface of this entertaining picture, beautifully produced in technicolor, lies a serious purpose—an endeavor to point out to American youth the way toward an attitude of enthusiasm and eagerness to participate in the new achievements and opportunities of our age. The defeatist philosophy which has done much to discourage young America is answered here—the answer being based on the facts of industry and on the faith of industrial leaders in the American youth.

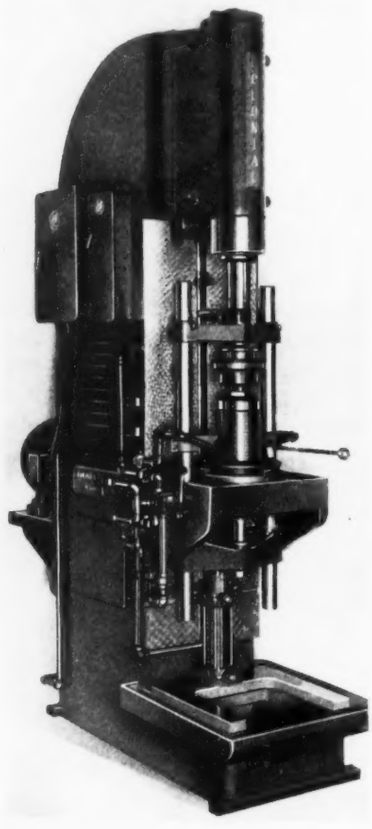


Fig. 1. (Left) Hydraulic Broaching Machine Equipped for Finishing Bore in a Large Ring Gear

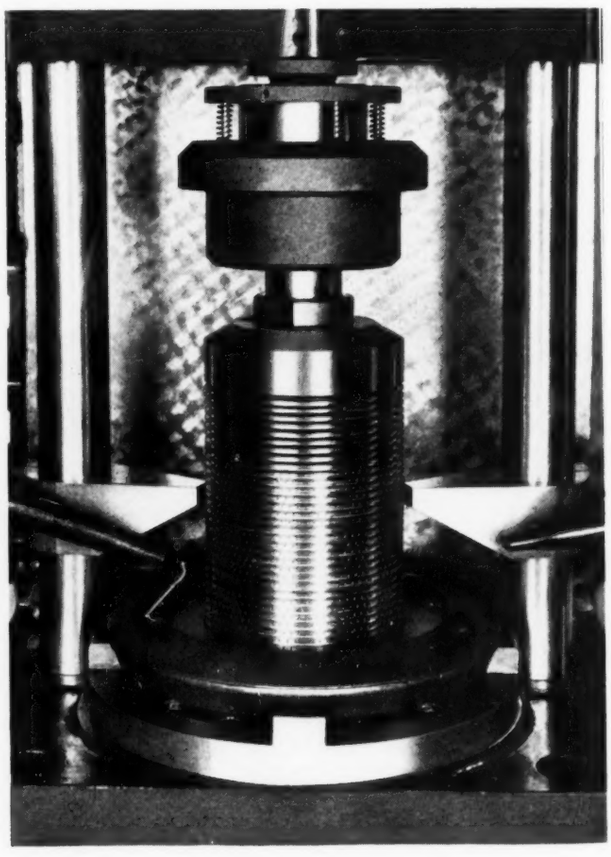


Fig. 2. (Right) Close-up View of Broach Used in Machine Shown in Fig. 1 for Finishing Hole Nearly 2 Feet in Circumference

Producing Heavy Machine Members by the Flame-Cutting Method

Massive Members are Flame-Cut from Steel Plate 20 Inches Thick to Simplify Construction of Powerful Hydraulic Machine

By GEORGE M. GILLEN
Lukens Steel Co., Coatesville, Pa.

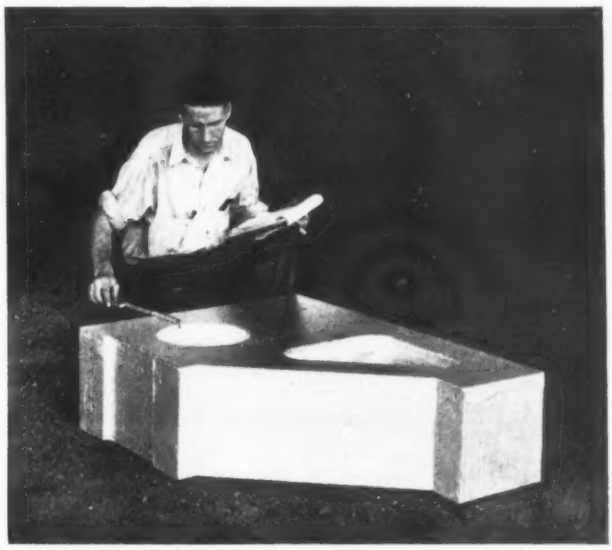


Fig. 1. Cover Support Weighing 4852 Pounds which was Flame-cut from Steel Plate 12 Inches Thick

HYDRAULIC metal balers of the type shown in Fig. 3, which have sufficient capacity to compress a worn out automobile or old motor truck into a bale of salable scrap metal, must be constructed of massive members, capable of withstanding tremendous pressures. The availability of steel plates in thicknesses up to 26 inches, from the 206-inch mill of the Lukens Steel Co., Coatesville, Pa., and the ability to flame-cut such heavy plate in the flame-cutting department of the By-Products Steel Corporation, has made it possible for the Logemann Bros. Co., Milwaukee, Wis., to advantageously employ massive flame-cut members, such as shown in Figs. 1 and 2, in building metal baling machines.

While the powerful baling machines built by this company are made in a number of types and sizes, all consist of a combination of hydraulic compression units which operate successively within a single box compartment, developing pressures up to about 750 tons. After the scrap material, consisting of bulky units such as worn out cars, trucks, etc., is charged into the box of the baler, the opening of a valve causes the cover to roll over the box and be forced down tightly by suitable locks, which prevent the scrap from escaping during the compressing operation.

The gathering ram then advances lengthwise through the box, stopping automatically at the end of its predetermined stroke, thereby compressing the scrap material into a mass in the forward end of the box. A more powerful intermediate ram

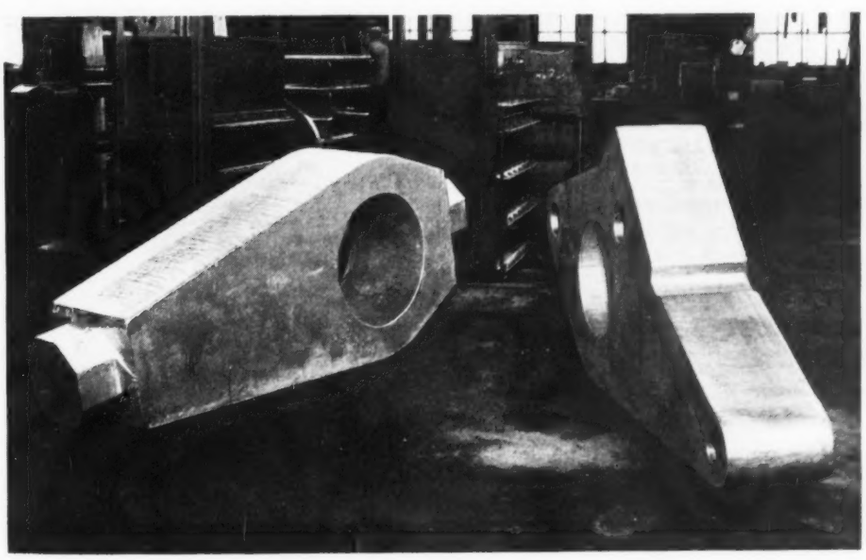


Fig. 2. (Left) Yoke for Logemann Hydraulic Metal Baler, Flame-cut from Steel Plate 20 Inches Thick, the Octagonal Ends being Produced by Flame-cutting to Facilitate Machining. (Right) Yoke for Metal Baling Machine that was Flame-cut from Steel Plate 12 Inches in Thickness

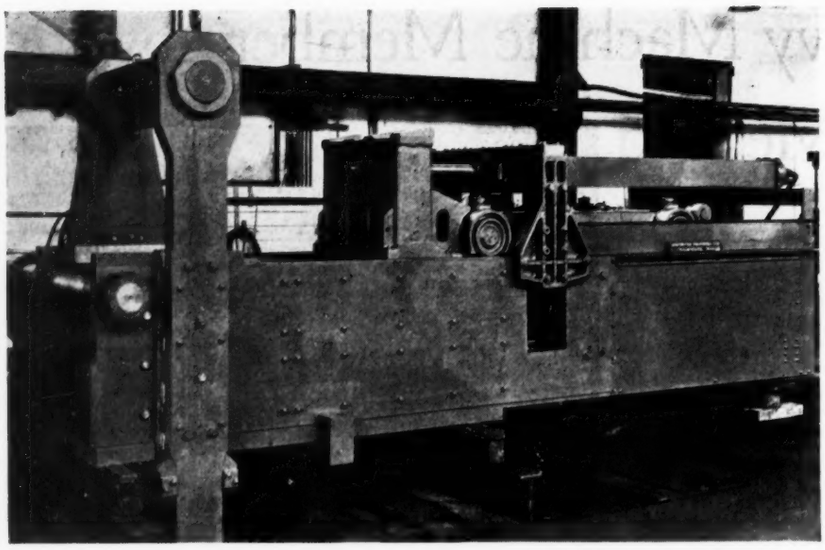


Fig. 3. Logemann Hydraulic Metal Baler with Important Members Produced by Flame-cutting Method

next moves in from one side, stopping automatically when the width of the bale of scrap has been reduced to the required dimension. Finally, the still more powerful finishing ram reduces the third dimension as desired. The result is an extremely tight, thoroughly interlocked bale of dense scrap which is in a salable form ready for the charging box that feeds the open-hearth furnace in the steel mill. Many Logemann balers, operating in the manner described, are now in service in automobile plants, stamping plants, steel mills, scrap yards, and other branches of the metal-working industries.

Flame-cut plates ranging in thickness from 4 to 26 inches are now used as standard construction for vital members of Logemann baling machines, such as yokes for supporting low pressures; and intermediate and high-pressure cylinders which absorb heavy loads as the bales of scrap are compressed. The cover front-wedge supports which move the box covers weigh 15,000 pounds, and must withstand a compressive force of 750 tons. The tension bars which connect the top and bottom yokes share the 750-ton load imposed by the high-pressure ram.

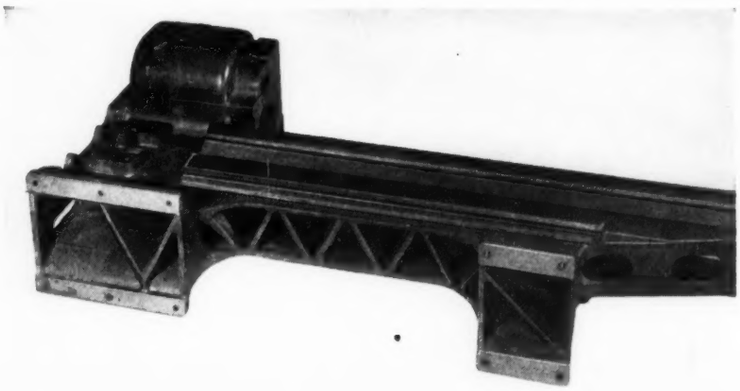
The use of flame-cut steel plates in building balers such as described has made possible a reduction in the weight of the parts, provided greater rigidity, eliminated failure of important members, and permitted greater flexibility in design.

* * *

Lathe Beds Designed for Maximum Strength and Rigidity

A new type of construction recently adopted for cast-iron alloy lathe beds by the Warner & Swasey Co., Cleveland, Ohio, is said to increase the strength and rigidity as much as 30 per cent. This construction, which is now standard on all but the smallest machines built by the concern, employs diagonal ribbing similar to bridge girder design, as may be seen from the illustration, instead of the conventional box type ribbing. In addition, all of the stiffening sections are on the outside walls of the bed. This gives greater freedom from twist and vibration and makes it easier for chips to fall through the openings into the pan. There is also greater space for chip clearance.

The diagonal ribbing extends into the section below the headstock which, together with an outer tie member between the head and the bed, considerably increases the strength in this section.



Diagonal Ribbing and the Provision of Stiffening Sections on Outside Walls have been Adopted by the Warner & Swasey Co. to Increase the Strength and Rigidity of Lathe Beds

Typical Examples of Work Handled on Contour Shaping Machines

Progress in the development of machine tools for high production has been accompanied by improvements in machines designed to handle unusual types of work in medium- and small-quantity lots. Contour shaping machines, such as the new model V 26 Doall, made by Continental Machines, Inc., Minneapolis, Minn., are now handling a large variety of special jobs in an interesting manner.

In Fig. 1 is shown a poppet valve lever produced by a three-dimensional contour sawing job performed on one of these machines equipped with an automatic power work feed. With this equipment, any curve can be cut by applying handwheel control, no hand pressure being required for any type

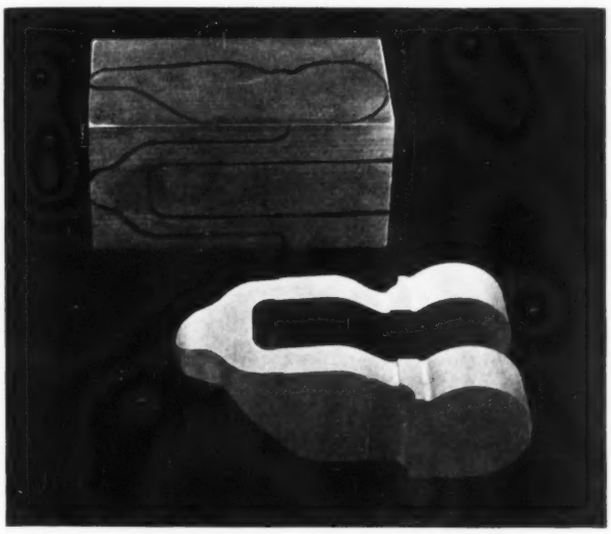


Fig. 1. Example of Three-dimensional Sawing Work Performed by a Contour Shaping Machine

of cut. The poppet valve lever illustrated is a typical example of the kind of work often needed in small lots for experimental purposes, which would be made as a forging if required in large quantities. In this particular case, only twenty levers were required for experimental use. To make the forging dies for such a small number of levers was, of course, out of the question. With the contour shaping machine, however, this part was machined in approximately three hours.

The spiral cut-out shown in Fig. 2 is another example of work produced by employing the new automatic feed and handwheel control of the contour shaping machine in cutting curves. This spiral part was cut from forging steel 2 1/2 inches thick in only one hour and forty-eight minutes.

A method of making experimental "stampings" without dies is illustrated in Fig. 3. Sheets of the required thickness are stacked up and then secured at the corners by welding, soldering, clamping, or other means. On the parts illustrated, fifty sheets

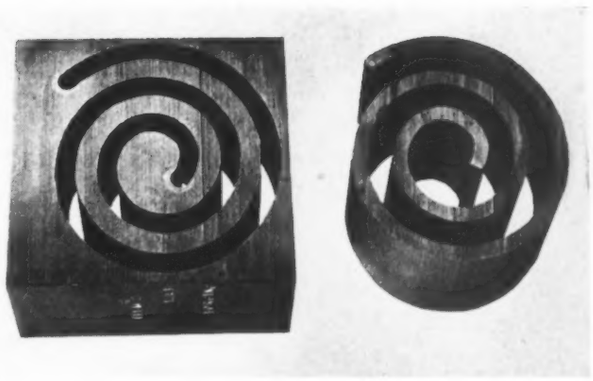


Fig. 2. Spiral Cut from Forging Steel 2 1/2 Inches Thick

of 0.020-inch thick laminated steel were stacked up and tack-welded at the ends. A lay-out on the top sheet was made for the two parts shown. These were then sawed out in thirty-five minutes. The lever part required twenty-two minutes sawing time, while the other part took only thirteen minutes sawing time. Any holes in parts of this kind are drilled in the stack before the sawing operation. If close tolerances are to be held at any point on the stampings, the cut-out parts can be fastened together through the holes and then filed to the exact size required on the contour shaping machine.

* * *

Index to MACHINERY

The yearly index to MACHINERY for Volume 45 (September, 1938, to August, 1939, inclusive) is ready for distribution. Subscribers who keep a file of MACHINERY can obtain copies upon request.

Fig. 3. Views Illustrating Method of Producing Sheet-metal Parts by Contour Sawing

Picatinny Advances the Art of Making Ammunition

Concluding Installment of an Article Describing Operations at Picatinny Arsenal, where Ammunition is Made for the United States Army

By COLONEL EDWARD M. SHINKLE
Commanding Officer, Picatinny Arsenal, Dover, N. J.

IN the first installment of this article, which was published in July MACHINERY, operations in the Metal Components Shop, where fuses are made, were described. The present installment will deal with an additional operation in that shop, and will describe the drilling of high-explosive in demolition bombs, and a scale, controlled by an electric eye, which is used for weighing out smokeless powder with extreme accuracy in loading shells.

An eight-station Waterbury-Farrel eyelet machine used for the production of detonator cups from aluminum strip, 3/4 inch wide by 0.032 inch thick, is shown in Fig. 10. The piece is blanked in the first station, at the right-hand end of the machine, to which the strip stock is fed automatically, and is then drawn to the required shape in the seven succeeding stations. When finished, the part is 0.239 — 0.002 inch outside diameter by 0.400 — 0.005 inch long. The bottom thickness is flattened to 0.027 — 0.004 inch.

The piece is transferred to the successive stations of this machine by means of a transfer bar, which has a reciprocating movement and picks up the pieces as they are raised by cams from the various dies. This machine produces 20,000 of these small cups in an eight-hour day.

There are, of course, a large number of highly interesting operations in the loading department, but only a few of these non-metal-working operations will be described. In Fig. 11 are seen three demolition bombs loaded with about 320 pounds of the high-explosive known as Amatol. This explosive is poured into the bombs in liquid form, and after it has solidified, a hole must be drilled in it to receive the fuse seat liner. The Rotor air drill used for this purpose is equipped with a 2-inch drill of special design, which allows the explosive to rise freely from the hole being produced. The drill is guided in a jig which is screwed on the end of each bomb casing to insure straightness of the hole with respect to the casing. The air drill is suspended from a pneumatic hoist attached to a hand crane, thus eliminating the necessity of having any electrical current in the room. The hole is drilled in the explosive to a depth of about 4 inches.

The loading of smokeless powder into cartridge cases is an operation that must be closely con-

Fig. 10. High-speed Eyelet Machine which Produces Small Cups from Strip Non-ferrous Metals at the Rate of About Forty per Minute

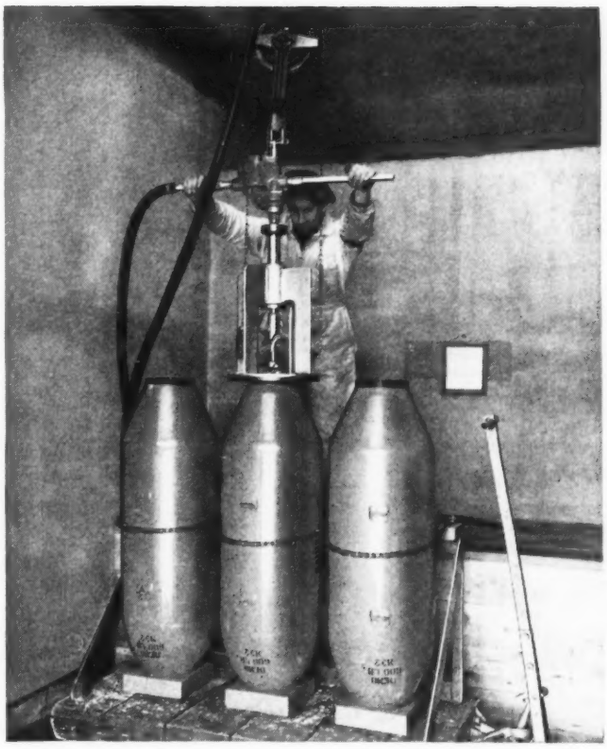


Fig. 11. A Hole Must be Drilled in the Solid Explosive in Demolition Bombs to Receive the Fuse Seat Liner

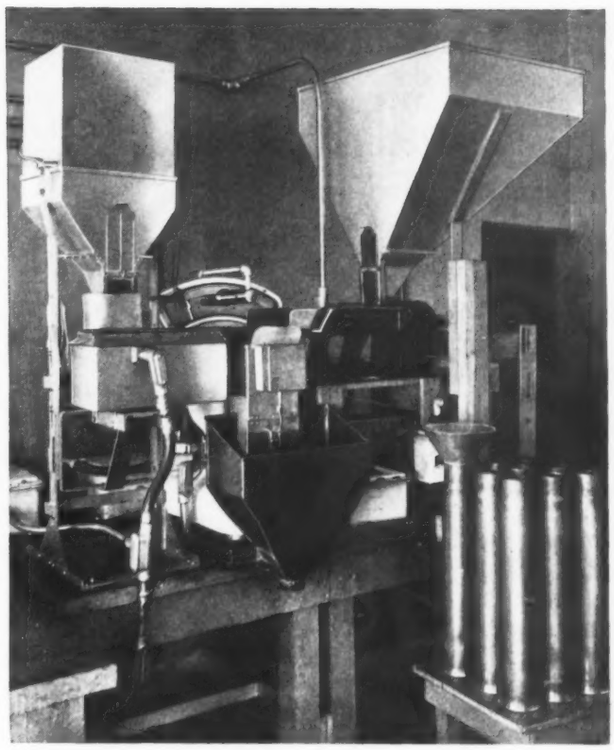


Fig. 12. Scale Equipped with Electric Eye, which Insures Accurate Weighing of the Powder Charge for Projectiles

trolled, because if the propellent charge is larger than prescribed, the shell will travel a greater distance than anticipated when discharged from a gun. Conversely, if the powder charge is less than the prescribed amount, the shell will fall short of the objective. To insure that the charge will be exactly right, the weighing of the powder is controlled by means of a highly accurate scale, as shown in Fig. 12, which is fitted with an electric eye that stops the automatic operation of the scale when the desired amount of powder has been fed from the hoppers into a compartment at one end of the scale beam.

The same kind of powder is fed from the two hoppers, which are located at opposite ends of the machine, the powder falling on vibrating trays that lead to the top of a chute. About 99 per cent of the powder is fed from the larger hopper at the right. When the charge in the receiving compartment is heavy enough to raise the scale beam, an electrical contact is broken, the tray of the right-hand hopper stops vibrating, and the indicator of the scale moves along the dial to the approximate final weighing position.

At the same time, powder keeps feeding along the vibrating tray of the left-hand unit until a narrow black line on the indicator coincides with a slit on the scale through which a light beam normally passes to the electric eye. When the light beam is thus broken, a trap-door is opened, allowing the powder charge to fall from the compartment to a metal container for loading into cartridge cases, such as seen at the right.

In a 3-inch cartridge case such as illustrated, the weight of the smokeless powder charge is 4 pounds 14.6 ounces. The tolerance in weight is about one-tenth of an ounce. It is interesting to note that, contrary to popular impression, smokeless powder is not really a powder. It has the appearance, both in color and shape, of pieces of spaghetti about 1/4 inch long.

* * *

American Screw Co. Wins Advertising Award

The cooperative advertising campaign pertaining to Phillips recessed-head screws, conducted by the American Screw Co., Providence, R. I., was recently selected by the National Industrial Advertisers Association as one of the twenty outstanding industrial advertising campaigns of the year. An award was made to the American Screw Co. at the recent convention of the Association in New York City. The campaign has been instrumental in widening the acceptance of this improved screw, which is manufactured by eleven other firms under license from the American Screw Co. These screws are largely employed in the automotive field, but are also used in the woodworking, electrical, aircraft, sheet metal, and kindred fields.

Up-to-Date Heat-Treating Practice in the National Acme Plant

By WILLIAM HOGG
Superintendent, Die and Tap Division
National Acme Co., Cleveland, Ohio

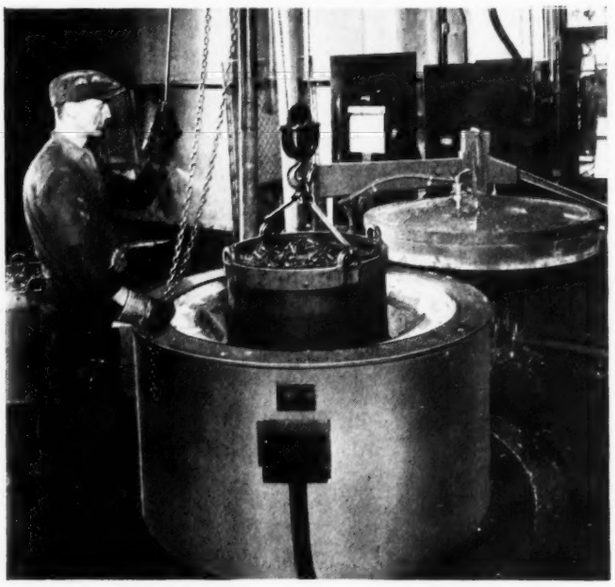


Fig. 1. Bolts being Stress-relieved by Heating in a Homo Tempering Furnace

THE heat-treating operations in the plant of the National Acme Co. are typical of those employed in an organization of such size that a practical combination of metallurgical science and the art of heat-treating must be devised. The company manufactures automatic screw and chucking machines, self-opening dies and taps, recording instruments, and screw machine products. It also does a large volume of contract manufacturing.

The main principle followed in equipping the heat-treating departments of the National Acme plant has been to provide furnaces, control instruments, and other heat-treating equipment capable of precise adjustment, so that the operating conditions can be varied accurately until the desired results are achieved, after which the same cycle can be repeated as often as necessary. In other words, the heat-treating equipment is thought of as a series of tools. These tools are used by both the heat-treater and the metallurgist to obtain the desired results in exactly the same way as machine tools are used to obtain the required dimensions of a machined part.

The heat-treatment of the steel usually begins outside the National Acme plant. There is a rather complete cooperation between the company and the supplying steel mill with regard to soaking, rolling, slabbing, drawing, and other mill operations. High-speed and special steels receive even more special attention. The steel stock passed by the company's receiving inspectors thus represents a real investment on the part of the company, even before it reaches its store-rooms. The fact that the part is to be heat-treated is never lost sight of during the forming and machining operations.

As a typical example may be cited the hardening of high-speed steel pipe-taps and thread-chasers. On reaching the heat-treating department, these parts are thoroughly cleaned and then loaded into a Homo forced-convection furnace. This type of furnace, originally designed for production tempering, has been found very suitable for this work, since it brings all parts up to the soaking heat with great exactness. Smaller tools are soaked at 1000 degrees F. for one hour; larger tools are soaked at 1200 degrees F. for about one hour per inch of thickness.

From the Homo furnace the parts are transferred to an electrode-heated heat-treating pot furnace, which is held at 1600 degrees F. by a Leeds & Northrup automatic control pyrometer. From this furnace the parts go to a high-heat pot furnace, held at 2330 degrees F. The use of pots at these very high temperatures has been found to result in ample penetration of heat, so that all parts reach the same temperature at the right cycle of time, with resulting uniformity of the heat-treated structure.

From the high-heat pot the tools pass to a salt-bath pot to be quenched at 1250 degrees F., following which they are quenched in oil. From the oil quench the tools pass to a Homo furnace and are drawn at from 1050 to 1150 degrees F.

In heat-treating all tool steels, except tungsten alloy steels, the company frequently makes use of Vapocarb-Hump hardening equipment. This equipment consists essentially of an electrically heated furnace supplied with gas made from Vapocarb fluid (a patented compound) in a separate cracking furnace. The Vapocarb fluid is controlled by a needle valve. The use of so finely adjusted a device as a needle valve may seem odd to heat-treaters accustomed to other gases, but in the case of the Vapocarb the closeness of control has been found extremely important. As a matter of fact, the supply of Vapocarb fluid is held within a few drops per minute of a specified rate.

An ingenious and effective furnace control is the so-called "rate of heating" control used in the Vapocarb equipment. The furnace has two thermocouples, one of which detects the temperature of the work, and the other the temperature of the furnace wall. Both of these couples are connected to

a Micromax recording controller in such a way that when the temperature difference between the work and the furnace wall exceeds a certain amount, the electric power of the furnace is cut off until the temperature of the work "catches up." Both the rate of heating and the temperature difference are recorded; the heat-treater, of course, has control over the rate of heating by means of the furnace rheostat.

Thus, by watching the record and adjusting the rheostat in accordance with the load, the heat-treater can select the best rate of heating and be certain that no excess heat will be built up while passing through the critical stage; at the same time, he avoids any runaway temperature in the work after it has passed through the critical stage. It is likely that the temperature-difference type of control will come more and more into use as furnaces are improved in design and operation.

In hardening alloy and carbon steel tools, the heat-treater watches the "hump" which signals the entrance into, and the emergence from, the critical stage. In many cases, the tools are quenched entirely with reference to the hump—that is, they are quenched a certain number of chart spaces above the hump, regardless of the final temperature. In other cases, the final temperature is the governing factor, but if the hump is not in evidence very near the expected point, it gives the heat-treater warning and enables him to vary his quench and draw procedure.

Proper quenching and drawing are just as important as proper heating. Quenching is at least as much of an art as it is a science. The knowledge as to which face of a tool should be immersed first, the quenching of interior surfaces, and the need for interruption of the quench two or three times can only be learned by experience.

It is important that the quenched tool should be drawn back as uniformly as possible. This is done in a Homo furnace. This type of furnace is used, not only in the preheating of high-speed steel, but also in tempering, normalizing, and strain relieving of screw machine products.

An indispensable tool in the heat-treating department is the hardness tester. These devices are used very frequently. The constant checking and rechecking salvages a tremendous volume of work which otherwise might be lost.

The exact savings effected by careful cooperation with the steel company, by close cooperation of metallurgists and heat-treater, by the use of modern heat-treating equipment, and by the thorough inspection of physical qualities in the steel and in the tools have never been completely computed, but are assuredly very great. Even in cases where no definite saving can be shown, it is held that a "hard to handle" process ought to be supplanted by an "easy to handle" one, as in the long run, more dependable results are certain to be obtained.

* * *

Time and Motion Study Meeting to be Held in Chicago

A National Time and Motion Study Clinic, sponsored by the Industrial Management Society, will be held at the Medinah Club, Chicago, Ill., Friday and Saturday, November 3 and 4. Friday morning will be devoted to visits to industrial plants. In the afternoon and evening of the same day, and all day Saturday, a number of papers will be read relating to time and motion study and labor's attitude toward cost-reduction work. In all, nine papers will be presented by authors having a wide experience in connection with the subjects dealt with. The Industrial Management Society is located at 205 W. Wacker Drive, Chicago, Ill.

Fig. 2. The Problem of Duplicating in the Factory Results Obtained in the Laboratory is Simplified by Employing a Vapocarb-Hump Hardening Furnace for Testing and Experimenting, as well as for Production Heat-treatment

Engineering News Flashes

The World Over

Permanent Magnet Lifts Nearly 1500 Times its Own Weight

The most powerful permanent magnet in the world for its size—one that will lift nearly 1500 times its own weight—has been developed in the Research Laboratory of the General Electric Co. by W. E. McKibben. The magnet weighs 1.85 grams, or about 0.004 pound, and has been made to lift 2750 grams (about 6 pounds) in tests. Although only about half the size of an eraser on the end of a pencil, the magnet will lift a 5-pound flatiron with ease. It is several times stronger than those previously made.

The magnet is made of Alnico, an alloy of aluminum, nickel, cobalt, and iron. This material was first developed in the General Electric Research Laboratory as a heat-resisting alloy to resist scaling and deterioration at high temperatures. Research on the magnetic properties of alloys of this type was carried on later, and a process of heat-treating developed, by which the magnetic properties were more fully brought out.

Alnico has been used in radios, motors, generators, and other electrical equipment for some time, replacing electromagnets which require current. In the new magnet, a steel sheath around the Alnico pellet directs the magnetic flux against the object being attracted, and also protects the magnet against demagnetization when not in use.

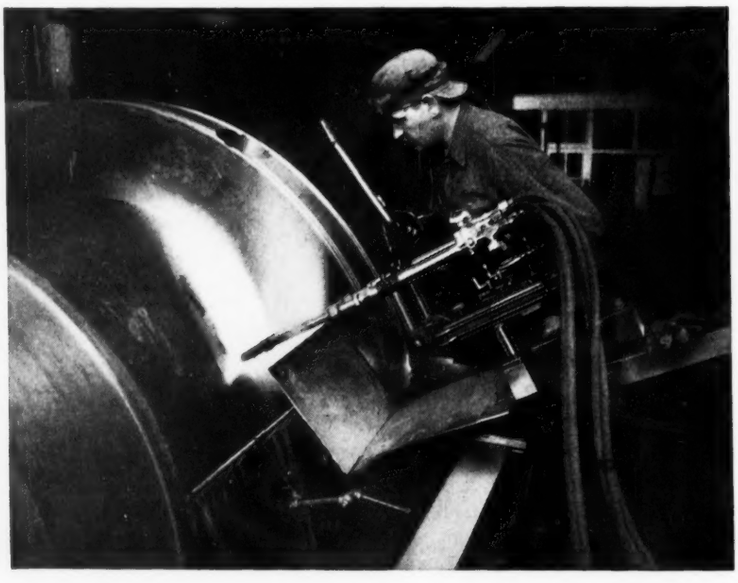
Some Facts about a Speed-Record Automobile Racing Car

The British racing car used by John Cobb in making speed records in Utah is said to have a gasoline consumption of just about one gallon to the mile. The car weighs over three tons, but because of its streamline shape it is said that the head-on resistance to its motion at 300 miles an hour is no greater than that for an ordinary car at 60 miles an hour. At its highest speed, there are 30,000 gas explosions a minute in the twenty-four cylinders of its two Napier engines, and the wheels turn around forty-six times a second.

Copper-Spun Rotor—A New Development in the Electrical Field

After years of research and experimentation, Fairbanks, Morse & Co., Chicago, Ill., has developed a one-piece centrifugally cast copper-spun rotor. In the past, materials such as aluminum, zinc, and white-alloy metals have been employed in one-piece rotors. While copper is obviously the best material available, it is only recently that manufacturing methods suitable for making use of copper have been worked out.

The rotor bars and the end rings are formed in one piece by pouring molten copper into a mold



Flame-hardening a Carbon-steel Spindle 63 Inches in Diameter at One of the Westinghouse Plants, Using Airco Oxy-acetylene Equipment. This is One of the Largest Production Operations Performed since the Development of Surface-hardening by the Oxy-acetylene Process

Testing a Yard-wide Ribbon of Thin Sheet Steel for Tiny Holes at Speeds up to 1000 Feet per Minute by Using Photo-tubes or Electric Eyes

that encases the punched laminations, which are stacked and held under pressure. The copper is poured from one end only while the entire assembly is spun at a high speed. The opposite end ring is formed by material that has passed through the rotor slots, thus insuring a fluid material during the entire casting process.

Owing to the action of centrifugal force, a tough, dense, ductile copper "winding" is produced, with high strength and uniform structure and conductivity. After the centrifugal casting is completed, the rotor is machined to make it true running.

Dynagraph Principle Applied to a Weighing Machine

The instrument known as a "dynagraph" is ordinarily used to measure very accurately the strain in the pumping rod of oil wells, recording loads up to 30,000 pounds. In its exhibit at the New York World's Fair, the Westinghouse Electric & Mfg. Co. has adapted this instrument to indicating the weights of persons up to 300 pounds. A man standing on the weighing platform stretches, through a fulcrum arrangement, a vertical rod to which the dynagraph is attached, and the strain is indicated in pounds by a pointer on a calibrated scale. The mechanism is wear-proof, through the use of elastic members, so that the machine is permanently accurate.

The Electric Eye Inspects Thin Sheet Metal for Defects

Holes much smaller than a pin-hole are detected in a yard-wide ribbon of thin sheet steel passing through a recently developed inspection machine at speeds up to 1000 feet per minute. A row of photo-tubes ceaselessly scans the sheet for holes and makes a conspicuous mark in the vicinity of each one that is found. In a single minute, sufficient sheet steel is scanned by this new Westinghouse device to make 5000 soup or milk cans.

Inspection of tin-plate steel for holes has been a troublesome problem. In rolling steel to almost paper thinness, some thin spots and small holes are inevitable. Holes almost too small to be seen are covered over in the tinning process, and in shipment, may cause loss of the product canned and possible damage to other goods. The pin-hole detector can be used for other materials, including rubber-coated cloth.

Nickel Tube with Hole One-Third the Thickness of a Human Hair

What is believed to be the smallest metal tube in the world has been placed on display in the West Virginia Building at the World's Fair in New York. This tube is made of pure nickel. The outside diameter is 0.0026 inch; the hole in the tube is 0.0007 inch—approximately one-third the diameter of a human hair. Wound into a coil, one pound of the tubing will have a length of eleven miles.

The tube is shown submerged in oil. Air forced through the tube actually blows bubbles. The tube itself can barely be seen with the naked eye, magnifying glasses being provided for visitors. For purposes of comparison, a common pin is suspended beside the tube by a strand of hair.

The tube was drawn to this small size by the Superior Tube Co., Norristown, Pa., from larger-sized tubing produced by the International Nickel Co., Huntington, W. Va. The small tube was produced especially for the Fair and has, as yet, no commercial applications, although pure nickel tubes of slightly larger diameter are used in hypodermic needles and for laboratory purposes.

EDITORIAL COMMENT

Perhaps the most serious industrial problem confronting our nation is the great economic waste represented by the enforced idleness of millions of employable people recorded as unemployed. The problem is one especially serious to those engaged in industry, whether as owners or as workers. Those employed are severely taxed in order to carry the unemployed on relief of one kind or another. Furthermore, since the average standard of living in this country has not improved during the last decade, the people of the country need what the unemployed could produce by their labor. It may also be safely said that there is general dissatisfaction with the methods adopted by the Government for handling the problem.

Some time ago, it was pointed out by a prominent industrialist that there are three ways—and three ways only—by which the unemployed can be put to work: (1) By the Government, which experience has shown to be expensive, inefficient, and contrary to the best interests of democratic institutions, since Governmental expenditures of the taxpayers' money are too easily converted into an indirect method of buying votes. (2) By himself, as when a man works alone and sells his own products. In this class, for example, are most of those who apply their labor to land in farming. We could all employ ourselves in this manner if we were willing to live in the meagre way necessary in subsistence farming, the same as the people of this country did some 150 years ago. (3) By industrial employment created by individual initiative in industry. Past experience has shown that in this way only is it possible to create the highest standard of living; and this high standard created by individual initiative has reached its highest level in the United States.

Three Ways by which Employment is Made Possible

This third method has constantly been referred to by Government officials, by labor leaders, and by the unemployed. They say: "Industry should provide the necessary employment." But industry can provide employment only if individual initiative and enterprise are encouraged instead of discouraged. It is one of the greatest paradoxes of our times that Government leaders should call upon industry to provide increased employment, and at the same time, do so much to hamper the effective efforts of that comparatively small group of people who have the ability to keep other people provided with employment. In fact, these Government and political leaders have actually done everything in their power to place obstacles in the way of those who have this comparatively unusual type of ability—that of keeping other people employed.

Few People Have the Initiative Needed to Employ Others

A study of the great number of failures in business and industry indicates that the ability to manage a manufacturing enterprise successfully is comparatively rare. That being the case, one might expect that those interested in providing employment for all of our people would encourage the type of individuals who possess this rare gift. It has well been said that very few people have the ability to manage an industrial enterprise, "not because it takes a higher type of mentality, but because it takes an unusual type of ability."

At the present time, there are obviously altogether too few people able to employ the great number who wish to work for somebody else in industry; yet the job of the industrial leader or manager has been made so difficult by the attitude of the Government and by recent legislation and tax burdens, that many previously successful industrial leaders now find it difficult, if not impossible, to succeed under present conditions. Again quoting an industrial executive: "Instead of being able to employ more men, we find ourselves forced to employ fewer. Worse than that, our Administration is discouraging those who would try to start an industrial enterprise from doing so."

Why Not Encourage Employment by Sane Public Policies?

When will the intelligent people of the country in all walks of life begin to recognize this problem and demand that there be an end to the methods inaugurated by Government to hamper industrial enterprise? If we want more employment in industry, the shackling of industry by unreasonable legislation must stop. Taxes, confiscatory in purpose and effect, and the unfair labor legislation of recent years need thorough reconsideration.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Mechanism for Reducing Oscillating Motion

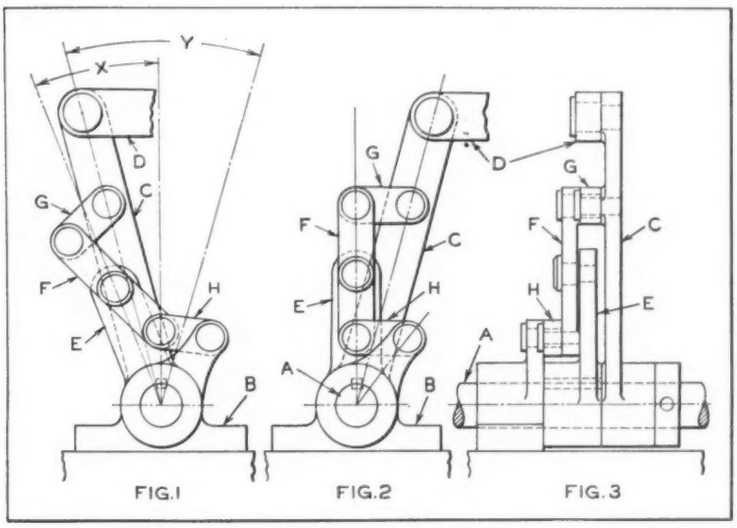
By L. KASPER

On a wire-forming machine, a part of the mechanism is operated by an oscillating shaft which receives its motion, through a system of links, from a crank. Owing to a change in the design of the product, the degree of oscillation of the shaft was required to be reduced. However, as other parts of the mechanism receive their motion from the same source, it was not permissible to change the throw of the crank, nor to change the positions of the connecting levers. The accompanying illustrations, Figs. 1 to 3, show the design of a mechanism that successfully met the requirements referred to.

The shaft *A*, which is required to oscillate, is carried in the bearing *B*. Lever *C* is given an oscillating motion by the rod *D*. Lever *C* and rod *D* are of the same dimensions and occupy the same positions as before the change, except that originally, lever *C* was keyed to shaft *A*, whereas with the new arrangement it oscillates freely on shaft *A*. Lever *E*, which is keyed to shaft *A*, carries the lever *F*, which is pivoted at its center. Bearing *B* carries a fixed arm which is connected to the lower end of lever *F* by the link *H*. The upper end of lever *F* is connected to lever *C* by the link *G*. Figs. 1 and 2 are end views of the assembly, and Fig. 3 is a side view.

In Fig. 2, rod *D* is shown at its extreme right-hand position. By tracing through the linkage, it will be noted that any motion of rod *D* is transmitted through lever *C* to lever *F* through link *G*. Lever *F* transmits the motion further through lever *E* to shaft *A*.

In Fig. 1, rod *D* is shown at its extreme left-hand position. It will be noted that, as the fulcrum of lever *F* is at its lower end, it is acting as a second-class lever, and any motion given to the upper end of lever *F*, which is the power arm, will be transmitted to lever *E* in reduced proportion. In Fig. 1, the angle *Y* indicates the movement of lever *C*, and the angle *X* indicates the movement of lever *E*, the difference between the two indicating the reduction accomplished through the linkage.



Mechanism by Means of which Oscillation of Lever C through Angle Y Produces Reduced Oscillation of Lever E through Angle X

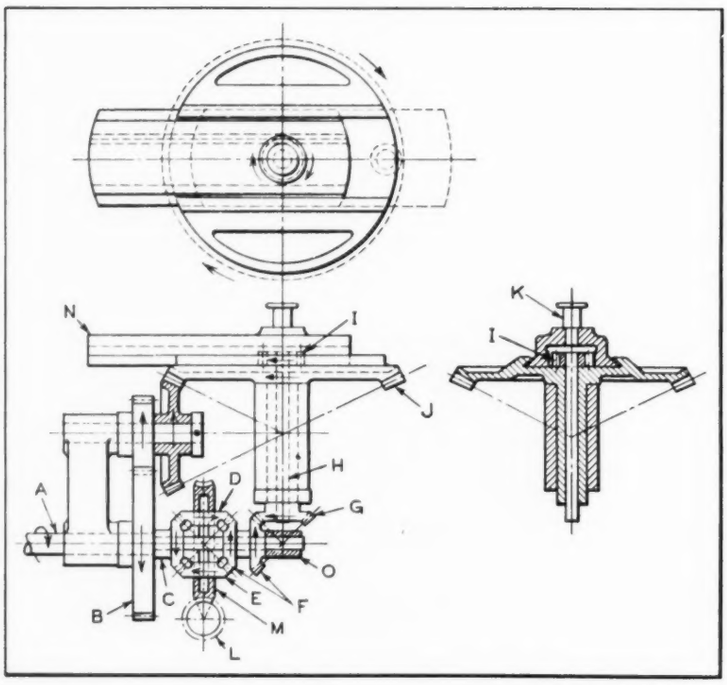
Variable-Stroke Mechanism

By M. JACKER

The principle of mechanically shifting the crankpin to increase or decrease the length of the stroke, as employed in the variable-stroke mechanism described on page 690 of June MACHINERY, was applied to machine shop shapers sixty or more years ago. In the shaper applications, a screw was used in place of the gear and rack incorporated in the more recent design for changing the position of the crankpin.

The writer has developed this principle of changing the stroke of a crank so that it can be employed to make adjustments while the mechanism is in operation. With this improved design, shown in the illustration (see next page), the stroke can be adjusted to any length within close limits from zero to the maximum length for which the mechanism is designed.

Referring to the illustration, driving gear *B* is keyed to driving shaft *A*. When gear *B* makes one revolution, it causes bevel gear *J*, which carries crankpin *K*, to make one revolution. Driving shaft *A* ex-



Mechanism for Driving Crankpin K from Shaft A, which Enables Throw or Distance of Crankpin from Center of its Shaft to be Adjusted while Mechanism is in Operation

tends through the differential gear assembly to the bearing *O*, but is reduced in diameter to accommodate the small bevel gears *F*.

The bevel gear *C* is keyed to driving shaft *A*. Worm-gear *M* carries two bevel gears *D* and *E* on studs fastened within its rim. Worm-gear *M* and bevel gears *F* have a free bearing on shaft *A*. Worm *L* engages the worm-wheel, and, unless turned by means of its handwheel, remains stationary, in which case bevel gear *C* transmits its motion through bevel gears *D*, *E*, and *F* to gear *G*. Gear *G* is keyed to shaft *H*, to the upper end of which is keyed the small gear *I* that is in mesh with rack teeth cut in sliding bar *N* which carries crankpin *K*.

When shaft *A* makes one revolution in the direction indicated by the arrow, gear *J* also makes one revolution. Simultaneously, the small gear *I* makes one revolution in the same direction as *J*, the result being the same as though gears *I* and *J* were fastened together. Any movement of the worm-wheel *M* by means of its handwheel, however, will cause gear *I* to revolve either slower or faster than gear *J*, depending on the direction in which the handwheel is turned. This increase or decrease in the speed of gear *I* will cause bar *N* to slide in or out, thus changing the radial position of crankpin *K* relative to the center of gear *J*.

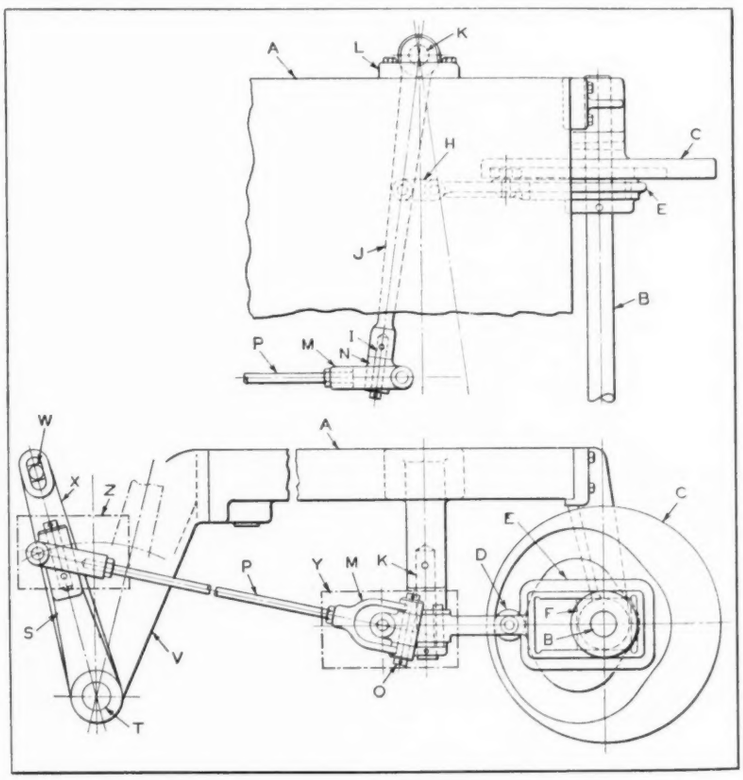
Exact setting for a given length of stroke is facilitated by a graduated dial on the handwheel. If the mechanism is required to operate at a fairly high speed, a specially designed double sliding bar would have to be substituted for slide *N* in order to keep the revolving unit properly balanced when adjusted to any stroke within its capacity.

Lever Mechanism Simplified by Means of Universal Joints

By FRANK HARTLEY

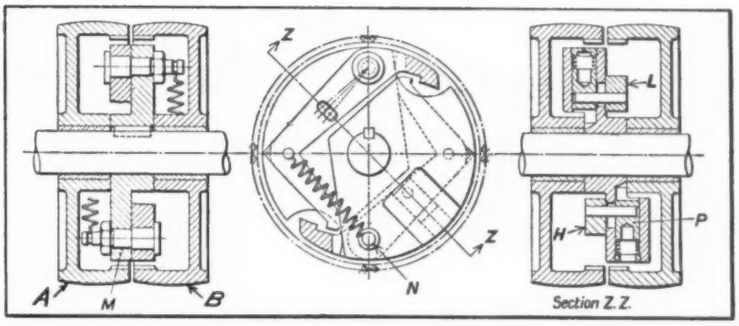
Transmitting a motion or movement developed at some point within a machine to some remote point for the operation of a secondary unit frequently introduces a perplexing problem. Often a combination of levers must be used for this purpose. In some cases, the problem can be simplified by equipping the connecting links or rods with universal joints, as here illustrated.

The mechanism shown is designed to transmit to lever *X* the oscillating motion imparted to lever *J* by cam *C*. Cam *C*, on driving shaft *B*, imparts a reciprocating motion to yoke *E* through roll *D* in the cam groove. Yoke *E* slides on block *F* located on shaft *B*.



Mechanism in which Universal Joints are Used to Simplify Transmission of Movement from Horizontal to Vertical Plane

It will be noted that both cam *C* and yoke *E* are located in a vertical plane and that lever *J* is in a horizontal plane, while lever *X* is in a vertical plane. Lever *S*, which is connected to reciprocating lever *J* by rod *P*, is also in a vertical plane. Thus, the problem of transmitting an oscillating motion to lever *X* becomes one of transmitting motion from a horizontal to a vertical plane. Obviously, this problem is greatly simplified by using universal joints to connect rod *P* with levers *J* and *S*, as indicated by the dot-and-dash lines *Z* and Y.



Automatic Two-speed Selective Clutch

Lever *S* is pinned to shaft *T* and transmits the required motion to lever *X*, which is also keyed to shaft *T*. Lever *X*, in turn, operates a slide mechanism which is connected to swivel-block *W*.

Referring to the construction of the mechanism, a portion of the machine frame is shown at *A* in both views. Bearing brackets on this frame support shaft *B* on which cam *C* is mounted. Yoke *E* is connected by pins to lever *J* through the medium of swivel-link *H*. Lever *J* is free to swivel about stud *K* as a center, stud *K* being carried in support *L* attached to frame *A*. In the end of lever *J* is a pin *I* on which block *N* is free to swivel. A pin *O* connects yoke *M* to block *N*. This construction provides a universal joint which permits yoke *M* to swivel in any direction. The two trunnion bearings of the two universal joints at the ends of rod *P* are located at right angles. Two brackets *V* support bearings for shaft *T*. With this arrangement, the tendency for the levers and connecting-rods to become cramped or jammed is eliminated.

Automatic Selective Clutch Mechanism

The automatic self-selecting two-speed clutch mechanism here described is designed to avoid the inadvertent rotation of the low-speed pulley *A* while accelerating to the high-speed clutch engagement of pulley *B*. These two pulleys are mounted freely with anti-friction bushings on the two-speed motor armature or the driving shaft. Though not so shown in the illustration, they are retained axially by collars or by the bearings of the machine. Internal serrations or suitable inserted pegs take the drive from the centrifugally actuated pawls *H* and *L*. The latter are accommodated in milled recesses on opposite sides of a driving disk *M*. Clearance notches in the edge of the disk allow the widened heel of the pawl which flies out first, to latch in the toe of the other pawl. The toes of the pawls must be designed so that they can both be held in simultaneously, but can never fly out at the same time. When latched in, a pawl must, obviously, be clear of the driven member.

The only parts that need be made for test are those attached to the driving disk. Examination of the assembly after each trial of the motor at either speed will reveal whether the appropriate pawl has reached the "out" or engaged position. The pulleys can be made later. It is not anticipated that any trouble would be experienced as the assembly decelerated.

Lugs are shown on opposite sides of the driving plate at 45 degrees to each pawl fulcrum *N*. They are bored to receive dash-pot pistons *P*. Driven into the pawl, and passing through a clearance slot in the disk, is a pin which must be provided with a little free movement in the piston to compensate for the slight difference between the circular and linear motions of the pawl and piston, respectively. Small compression springs in the dash-pots maintain contact between the pistons and the pawls. Modification to the dash-pots can be effected by a needle valve or choke (not shown). When at rest, the pawls are held in their inmost positions, abutting against the seats milled on the disk *M*, by springs in tension. Though not so shown, these springs should be without loops and wound on holders to facilitate adjustment.

It may be assumed that the motor will attain its speed of either 1440 R.P.M. or 720 R.P.M. in one second, and for convenience of illustration, it will be supposed that the centrifugal force, in ounces, on the pawls at any time would be equal to the square of the speed in revolutions per second. This force at 720 R.P.M. will be 144 ounces, or 9 pounds, and the high-speed driving pawl *H* must be held out of engagement with its mating internal serrations by means of a 9 1/2-pound spring. The low-speed driving pawl *L* will only be restrained by an 8 1/2-pound spring, and thus be free to take up the drive as it is displaced outward by centrifugal force at 720 R.P.M.

The essential feature of this design is the dash-pot control of the speed with which the pawl *L* flies outward. The vent in the dash-pot is adjusted to delay the movement of the pawl *L* and thus enable the pawl *H* to pass first through the interlock position when the motor is switched into high speed, although the pawl *H* has the heavier spring.

The selection will be so rapid and the effect of cumulative variations so unpredictable that calculation of the dash-pot vent and the best spring loads for a specific application will not be as satisfactory as experimental setting. The high-speed pawl can probably be arranged to engage at 800 R.P.M. H.S.G.

New Hydraulic System Developed for a Small Grinder

By R. E. PRICE and F. A. FIRNHABER

Various Combinations of Hydraulically Controlled Movements Designed to Reduce Floor-to-Floor Production Time are Incorporated in a New Plain Grinder of Small Size Built by the Landis Tool Co.

THE hydraulic system shown diagrammatically in Fig. 1 is one of the most recent developments of this kind in the machine tool field. This system, together with the electrical equipment, provides a simplified control over the comparatively large number of movements transmitted to the members it drives or actuates. The flexibility and the accuracy with which the various movements are controlled are outstanding features. A viscosity compensator developed by the Landis Tool Co. is an important feature of the system in its application to the Landis 4H plain hydraulic grinder described and illustrated in September MACHINERY, page 38. The general design of this grinder is shown by the wood model, Fig. 4.

Controls Employed for Hydraulic System

A close-up view of the rear of the 4H grinder with the cover plate removed is shown in Fig. 2. The pump driving motor and valves of the hydraulic system are shown in the upper left-hand compartment. The lower compartment and the one at the right contain the electrical equipment, including the motor with its wires sheathed in lead cables.

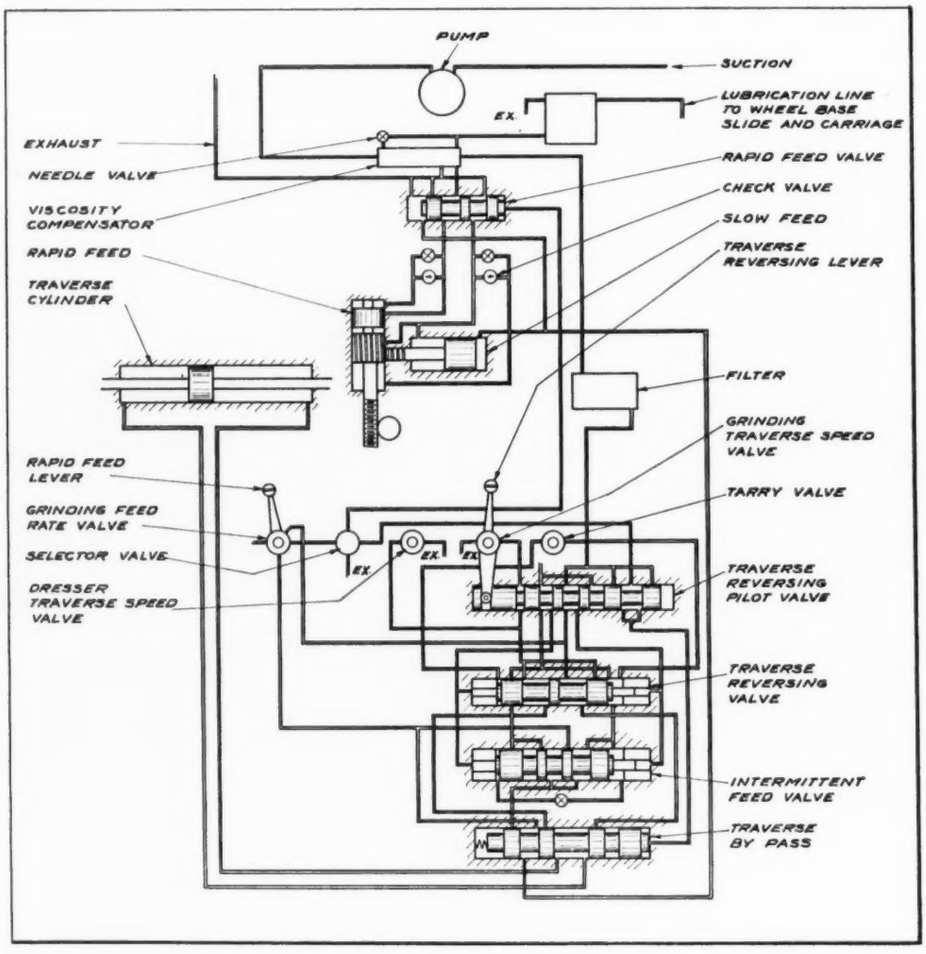


Fig. 1. Schematic Diagram of Hydraulic System for Operating Traversing Table and Feeding Movements of Grinding Machine

The view of the grinder base, Fig. 3, shows the large door at the right-hand side open to give access to the main traverse valve, filter, and valve for the hydraulically operated footstock. The rapid-feed lever and the knob at its center for operating the grinding feed rate valve are shown at the upper extreme left in a convenient position for the operator. At the right of these controls is the knob for operating the selector valve, which permits the operator to change over quickly from traverse grinding to plunge-cut grinding or vice versa.

At the right of the selector-valve knob is the knob for controlling the traverse speed used in truing the wheel. The wheel-truing bar is built

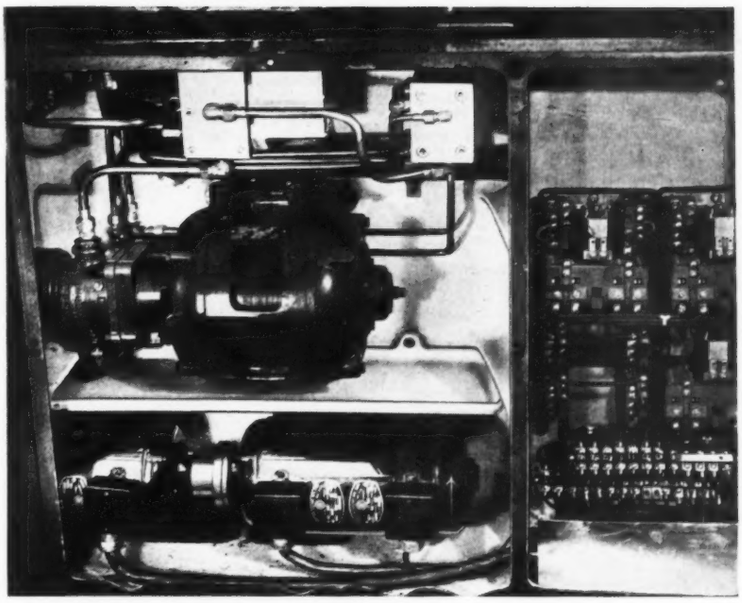


Fig. 2. Close-up View of Rear of Grinding Machine with Cover Removed, Showing Hydraulic Pump Drive, Valves, and Motors

into the footstock base, and is adjusted by a graduated knob to obtain any desired work diameter within the range of the machine. The wheel-dressing operation can be performed without disturbing the set-up.

Next in the line of controls is seen the traverse-reversing lever, provided with a knob at its center for operating the valve that controls the grinding traverse speed. At the right of these controls is a knob that operates the "tarry" or dwell valve. The location of these controls in the hydraulic system is shown in the diagram Fig. 1.

Referring to the upper right-hand corner of the diagram, it will be noted that there is a lubrication pipe line to the wheel-base, slide, and carriage. The viscosity unit, which compensates for changes in viscosity due to variations in the oil temperature, performs the important function of keeping all speeds and feeds constant when once adjusted.

The piston that operates the traversing movements of the grinding machine table is actuated by oil pressure. The oil, under pressure, acts on both sides of the piston-head, being alternately admitted to and forced from each end of the cylinder. As shown diagrammatically, the rapid feed is obtained by oil pressure acting directly on the piston-head, whereas a combination rack attached to a piston transmits the slow feeding movement through a pinion and worm.

In designing the Landis 4H hydraulic plain grinder, considerable stress was placed on the importance of producing a machine of pleasing, symmetrical appearance. To facilitate the solution of this problem and at the same time insure the development of a machine of the greatest possible utility, a scale model one-fourth actual size was constructed of wood, as shown in Fig. 4. The construction of this model was begun early in the preliminary stages of development when the lay-out drawings were being made. All movable and removable parts of the wood model were made separately, the wheel-base and carriage moving on their respective vee and flat guides as on a regular machine. The footstock was made slidable on the swivel-table, which can be swung around on the carriage to the maximum taper angle. All flush doors and covers were outlined on the surfaces accommodating them, while control buttons, levers, and handwheels were made true to scale.

The grinding wheel guard nose was made movable, and the wheel was coated with sand cloth to simulate a grinding wheel. All adjustable or moving units have movements equivalent to those on the finished machine. This arrangement made it easy to observe lengths of travel, overhang, and the floor space occupied, and to readily visualize the machine as a complete unit. Wooden figures representing an operator of average size in standing and sitting positions were cut out to one-fourth scale size and placed at the machine in order to check the position of the levers for ease of operation.

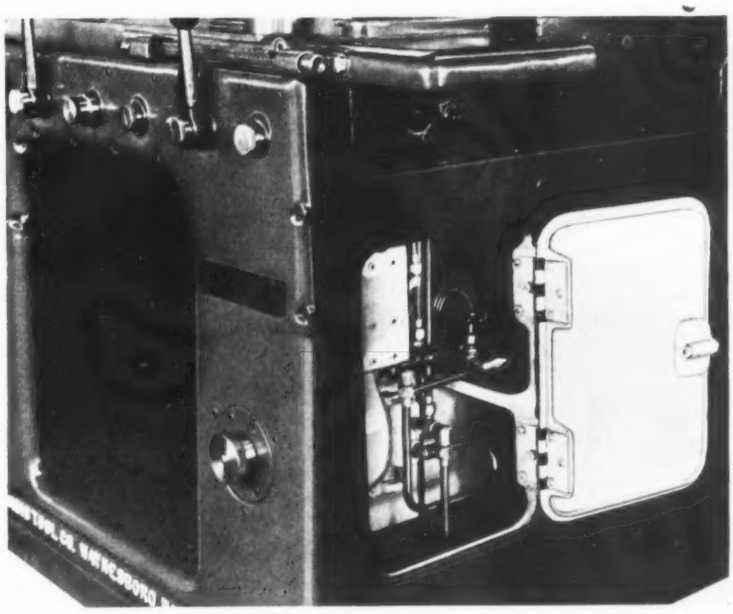


Fig. 3. Base of Hydraulic Grinding Machine with Door Opened for Easy Access to Main Traverse Valve, Filter, and Valve for Hydraulically Operated Footstock

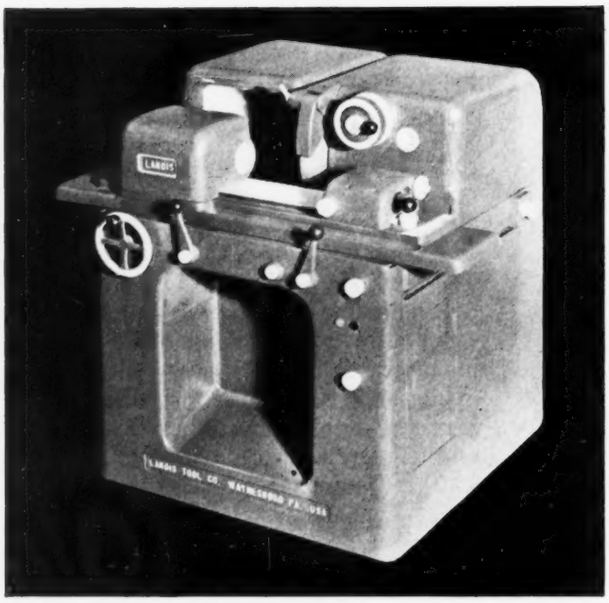


Fig. 4. Wooden Model of Hydraulic Grinder, Made One-fourth Actual Size during Preliminary Lay-out to Facilitate Design Work

The clean lines, smooth surfaces, and corner radii of the finished machine are attributed, in large measure, to the use of the scale model. With the wood model, it was easy to locate the wheels, levers, knobs, and covers to give a balanced appearance. All patterns were carefully matched to produce smooth surfaces at all joints. In fact, the joints between the main castings are hardly discernible. All projecting parts are kept as close to the machine surface as possible. Door and cover hinges are concealed, while the handles for these parts are depressed in the castings. The exposed parts of the machine that are subjected to frequent handling are chromium-plated.

Conference of the Rock River Valley Engineering Council

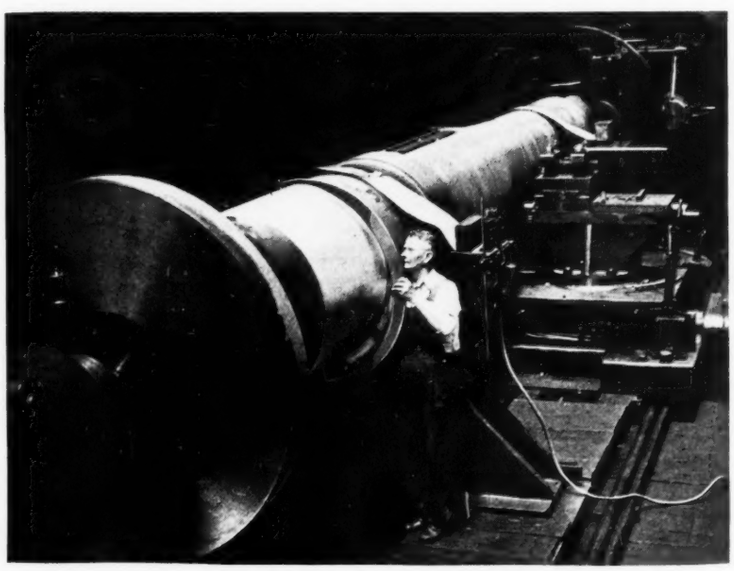
The Rock River Valley Engineering Council and its Associated Societies held a two-day engineering conference for plant executives, engineers, and "key men" connected with the manufacturing industries, in Rockford, Ill., Friday and Saturday, October 13 and 14. During the meeting, the local machine tool and other metal-working plants held open house, giving visitors the opportunity of seeing new developments in machinery, equipment, and methods.

The societies affiliated with the Rock River Valley Engineering Council are the American Foundrymen's Association, the American Society for Metals, the American Society of Mechanical Engineers, the American Society of Tool Engineers, the National Association of Power Engineers, the Rockford Engineering Society, and the Society of Production Engineers. In connection with the conference, a dinner meeting was held at the Faust Hotel, Friday evening, and a meeting of the National Association of Power Engineers was held on Saturday afternoon. At the latter meeting, heating, ventilating, and air-conditioning were the principal subjects discussed.

* * *

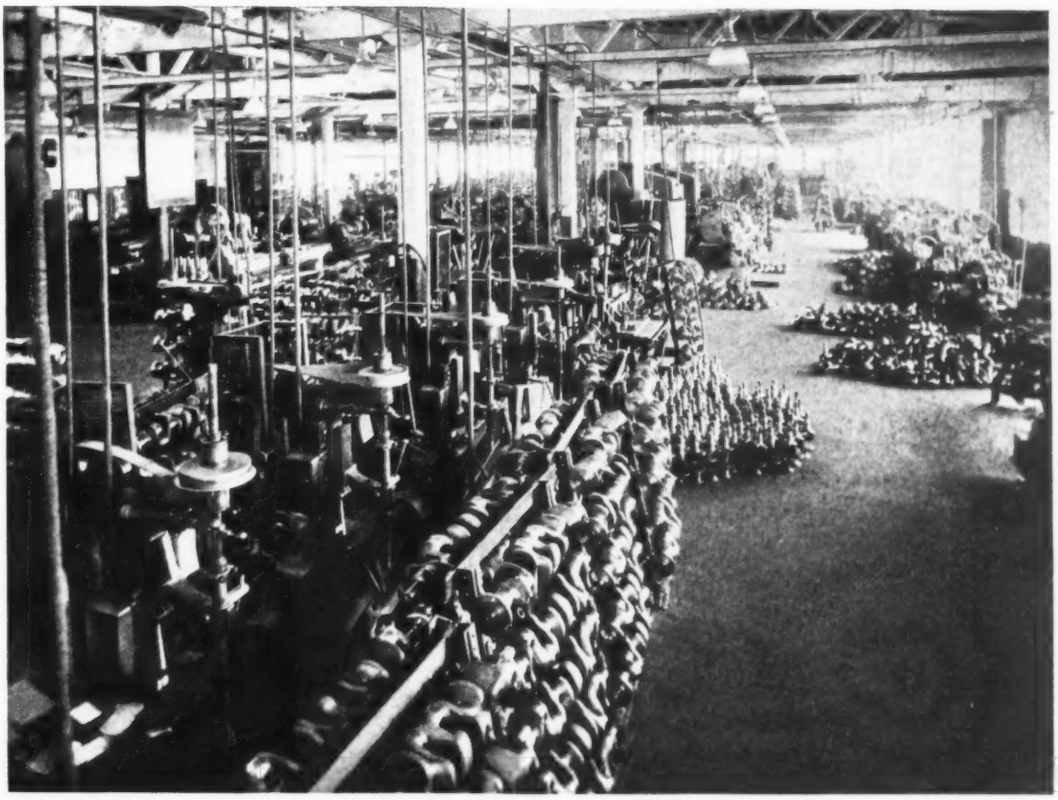
Sixtieth Annual Meeting of A.S.M.E.

The sixtieth annual meeting of the American Society of Mechanical Engineers will be held in Philadelphia, Pa., December 4 to 8. An attendance of 3000 engineers is expected at this meeting. All the functions of the sixtieth annual meeting, which is the first to be held outside of New York City since 1890, will take place at the Bellevue-Stratford Hotel. Present plans call for thirty-five technical sessions with 105 papers.



Turning a Shaft of the Size Shown in the Illustration to Limits of Plus or Minus 0.0005 Inch is a Slow, Painstaking Job. This Shaft is for a Large Water-wheel Generator, Built at the East Pittsburgh Works of the Westinghouse Electric & Mfg. Co. The Largest Diameter of the Shaft is 36 Inches; the Smallest Diameter is 28 Inches

Special Methods in a Jobbing Crankshaft and Camshaft Shop



THE manufacture of crankshafts for automobiles was started back in 1902 by the Atlas Mfg. Co., Fostoria, Ohio, which is believed to be the oldest concern in existence devoted to the production of crankshafts for internal combustion engines. Shortly after the World War, the plant was taken over by the Chandler Motor Co., and in 1929 by the Hupp Motor Car Corporation, which expended approximately $1,000,000 for new machinery.

Since the latter part of 1937, the concern has been independent, and has been engaged in the manufacture of crankshafts and camshafts on a jobbing shop basis. These parts are being produced for automobile, airplane, motor-truck, Diesel, marine, and stationary engines, as well as for compressors and pumps. The heading illustration shows a general view of the shop, which is 450 feet long by 108 feet wide. Production and inspection methods developed to meet the special needs of this plant will be described in this article.

As the crankshafts for various makes of cars and trucks must be produced on the same machines, provision had to be made to enable quick and accurate change-over of the tools. In Fig. 1 is shown a close-up view of a Wickes lathe employed for turning five main bearings on a motor-truck crankshaft simultaneously, and for facing the crankpin cheeks adjacent to these bearings. Tools on the front of the lathe carriage are fed straight in for the turning cuts, these tools being of the same width as the bearings. The facing cuts are taken by tools at the rear of the carriage, which are also fed straight in. Two tools are mounted on each of the rear holders for the facing cuts.

All the tool-holders are adjustable sidewise along the front and rear of the carriage to facilitate positioning them to suit the longitudinal distances between the bearings on different crankshafts. Similarly, the tool-holders can be adjusted in and out for turning to different diameters. The tools can be readily changed to suit bearing widths.

In shoulder-grinding operations, difficulty was formerly experienced in preventing burnt crankshaft surfaces. It was determined that this condition was the result of the grinding wheel sides not being kept clean of chips and abrasive. To eliminate this condition, all machines used for shoulder-grinding operations were equipped with

Fig. 1. Adjustable Tooling on a Crankshaft Lathe Facilitates the Changing of Tool Setups to Suit the Various Makes of Crankshafts Machined on the Lathe

pipes for directing a strong flow of coolant against each side of the grinding wheel, as shown in Fig. 2. Burnt shoulders on the work have thus been completely eliminated, as the "side washing" maintains free-cutting wheel surfaces. The shoulders can be ground smoother than before, and less frequent dressing of the grinding wheels is necessary.

Coolant is also delivered to the face of the grinding wheels, and each machine is equipped with a Fostoria filter (developed in this plant) through which the coolant is forced after it flows from the grinding wheel and work. The crankshaft seen in Fig. 2 is for an airplane engine.

A straightening fixture that has proved advantageous because of its adaptability to a large variety of crankshafts is illustrated in Fig. 3. The crankshaft is supported on centers, as shown, and also by two V-blocks that take the straightening load. Above and to the rear of the crankshaft may be seen a bar on which a dial gage slides, the gage being positioned above any main bearing in order to determine its concentricity with respect to the center line of the crankshaft.

At the back of the fixture is a series of hook-like arms which may be swung forward into contact with any of the main bearings as seen at *A*. These hook-like arms are mounted on an eccentric shaft that can be swiveled by the long handle *B* at the right-hand end of the bench. As the eccentric shaft is swiveled, downward pressure is applied to the crankshaft through one or more of the hook-like arms. In this way, a crankshaft can be conveniently straightened within the required limits, as determined by bringing the spindle of the dial indicator in contact with the main bearings and revolving the crankshaft. The hook-like arms are equipped with brass shoes to avoid marring the bearings.

A device employed for determining the parallelism of crankpin bearings with relation to the main bearings is illustrated in Fig. 4. It consists of an arm that is supported from the crankpin bearings by a brass block approximately the same width as the bearings. At the lower end of the arm is a weight, and mounted on the flat upper surface of the weight is a spirit level.

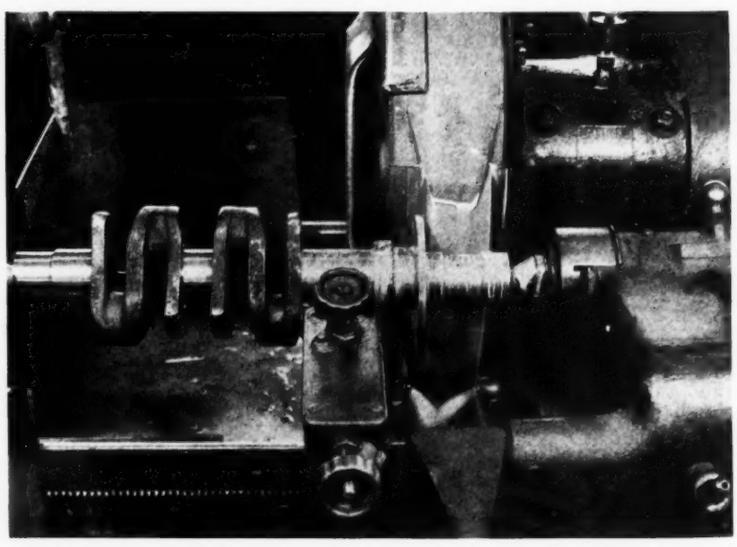


Fig. 2. Delivery of Coolant to Each Side of the Wheel in Shoulder-grinding Operations Eliminates Burnt Surfaces on Work and Enables Smoother Surfaces to be Produced

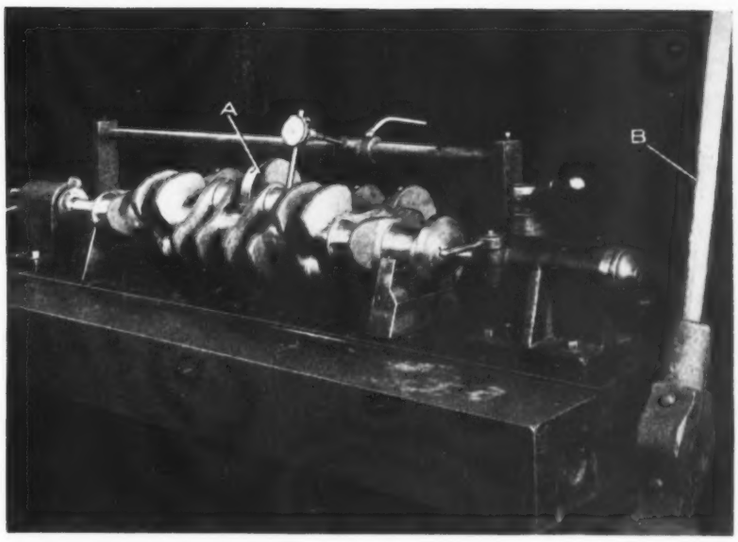


Fig. 3. Fixture Designed for Straightening Crankshafts in a Jobbing Shop, a Series of Arms being Provided for Exerting Pressure on the Various Main Bearings

The crankshaft is supported in V-blocks on three of its main bearings, and the inspection device is placed successively on each of the crankpin bearings, as shown. The amount that any bearing is out of parallel with respect to the center line of the main bearings can readily be determined by observing the appearance of the bubble in the spirit level. The inspection device is tilted in accordance with the out-of-parallelism, due to the fact that the weight keeps the upper brass shoe in close contact with the crankpin bearing being inspected, and any tilting is indicated by the spirit level.

Each graduation on the spirit level indicates 0.001 inch out-of-parallelism at a distance of 12 inches from the center of the crankpin. The closeness of the reading may be emphasized by pointing out that when a cigarette paper is placed under one side of the brass supporting block, the bubble in the spirit level moves past twenty graduations. The customary allowance in the inspection of crankshafts is 0.006 inch of tilt at the spirit level, which is equivalent to 0.0003 inch out-of-parallelism on the length of the pin. Crankpin bearings are checked around their entire circumference by means of this device.

In Fig. 5 is shown an ingenious inspection fixture designed to check camshafts for throw, rise and fall points, angular location, and spacing of the cams, as well as for concentricity of the cam basic circle. Each camshaft is mounted in bearings in the same way as it will be assembled in an automobile motor. An indicator dial, reading in tenths of an inch, is slid along the rail on which it is mounted, in order to position a valve lifter attached to its spindle successively on each cam. The rail is graduated to facilitate settings for each intake and exhaust cam.

At the left-hand end of the fixture is a large graduated disk, which is turned to various settings, in order to bring the opening and closing points of the cams beneath the valve lifter of the indicator. By watching the indicator needle, the inspector can readily determine whether the rise and fall points are properly located on the cams, and whether the amount of rise is within specified lim-

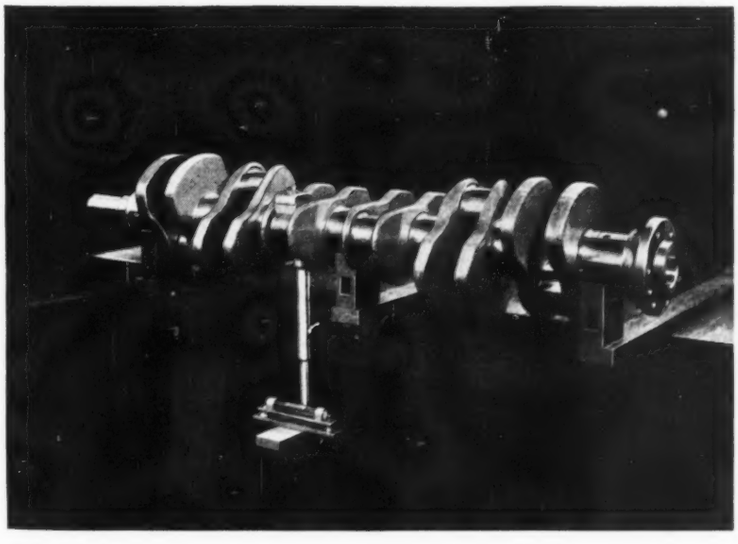


Fig. 4. Spirit-level Gage Employed for Determining within Close Limits the Parallelism of the Crankpin Bearings of a Crankshaft with Relation to the Main Bearings of the Shaft

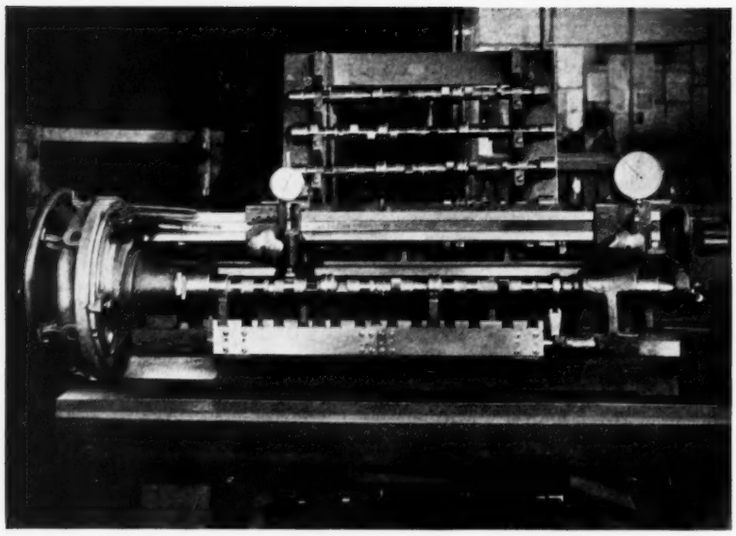


Fig. 5. Fixture Designed for Checking the Rise and Fall Points of Cams, as well as the Amount of Throw, the Concentricity of the Cam Basic Circles, and the Spacing of the Cams and Other Elements

its. The graduations on the indexing disk are about 1/8 inch apart. The indicator dial seen at the right-hand end of the rail is employed in checking narrow rings, such as, for example, fuel-pump eccentrics.

Below the camshaft is a spacing bar, mounted on a shaft in such a manner that it can be conveniently swung upward into contact with the camshaft for determining whether the cams and other elements are spaced according to specifications. The inspection fixture is shown in the illustration set up to suit a camshaft for an eight-cylinder automobile engine. To adapt the fixture for other camshafts, it is merely necessary to change the spacing bar and the indicator-setting scale on the upper rail of the fixture to suit the new job.

* * *

Welded Flange Joint of Unique Design

By GEORGE B. CRAMP

A self-aligning, light-weight flange joint of welded construction, which can be used for assembling piping, as well as machine parts and equipment, is shown in the accompanying illustrations. Fig. 1 shows two mating flanges ready for assembly, while Fig. 2 shows the two flanges drawn together by means of special T-bolts. The T-head bolts are welded to the outer rims of the flange plates, thus eliminating the common practice of drilling holes through the flanges to receive the fastening bolts.

The heads of the bolts on one flange permit the bolt ends of the mating flange to project between them, the ledge of the flange providing adequate support for the nuts when they are screwed on the bolts, as shown in Fig. 2. This arrangement permits the bolts to be spaced much closer together than would otherwise be possible.

When this type of joint is used for piping, the T-head bolts are welded to a ring or flange that is slipped over the pipe and welded in place. The great saving in material resulting from the use of this type of flange is an important advantage. A set of 6-inch conventional cast-iron pipe flanges and fastening bolts, for example, weighs 40 pounds, as compared with 18 pounds for a pair of 6-inch welded type flanges. The outside diameter of the welded type flange is also much smaller than that of a standard flange.

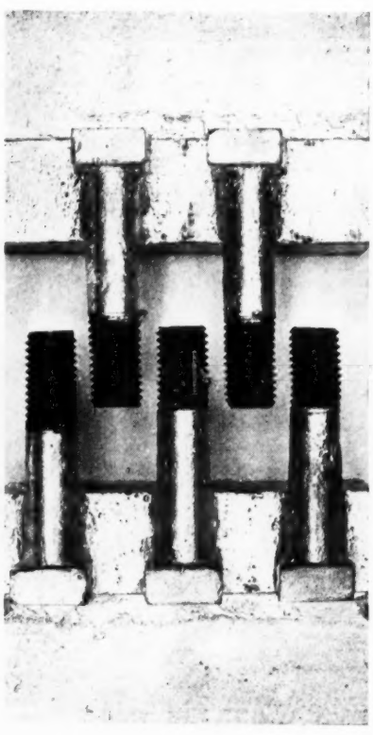
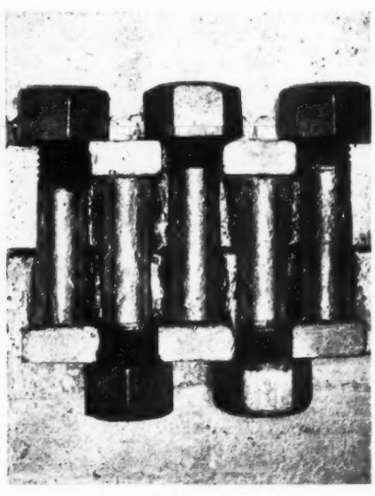
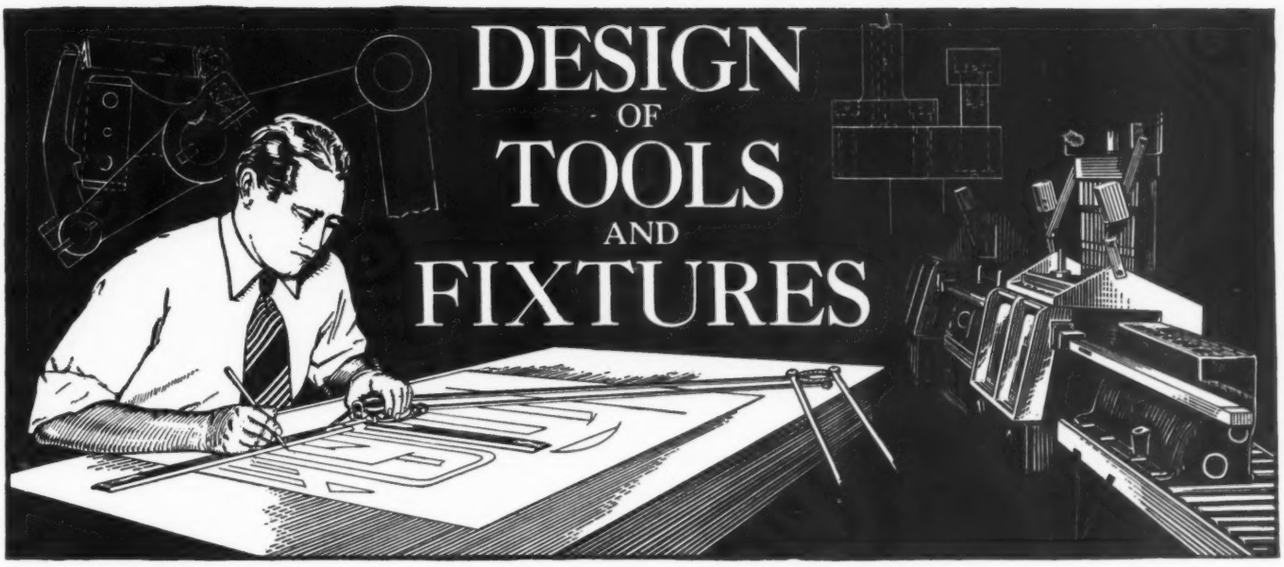


Fig. 1. (Left) Flanges with Assembling Bolts Welded to their Rims

Fig. 2. (Below) Joint Formed by Assembling the Flanges Shown in Fig. 1





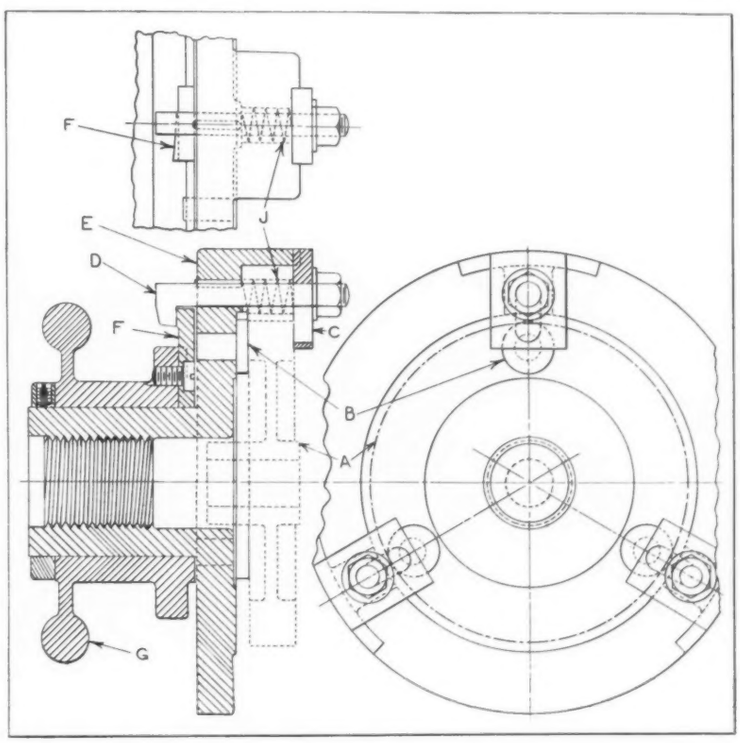
Clamping Fixture for Holding Work while Grinding Center Hole

By EDWARD L. PETERSON, Chicago, Ill.

The accompanying illustration shows a clamping device that was designed for holding flat disks while grinding the center hole. The interesting feature of this device is the cam action that causes the clamping bolts simultaneously to apply equal pressure on the work when the handwheel is turned.

The work *A* rests on the three buttons *B*, which are hardened and ground so that the sides of the disk are held square with the center of the grinder spindle. Three clamping pieces *C* hold the work in place. The draw-bolts *D* are actuated by cams *F* and are a sliding fit in piece *E*. Springs *J* hold clamps *C* in place.

In clamping the work, the handwheel *G* is turned in a direction opposite to that of the grinder spindle rotation. This actuates cams *F*, which causes bolts *D* to move inward and clamp work *A* securely between buttons *B* and clamps *C*.



Clamping Fixture with Cam-actuated Draw-bolts

Unusual Set-Up for Numbering Graduated Circles

By O. S. MARSHALL, Pasadena, Calif.

Rather an unusual set-up for etching numbers on a graduated circle is shown in the illustration (see next page). The cast-iron part *A* to be etched is 15 inches in diameter and has a large square hole, making it necessary to hold it on an auxiliary plate. This plate, in turn, has a 1 1/4-inch round hole that fits the mandrel on which it is mounted. The part to be etched has a flange *B* of somewhat smaller diameter than the graduated circle. This flange affords a convenient means for clamping the work on plate *C*.

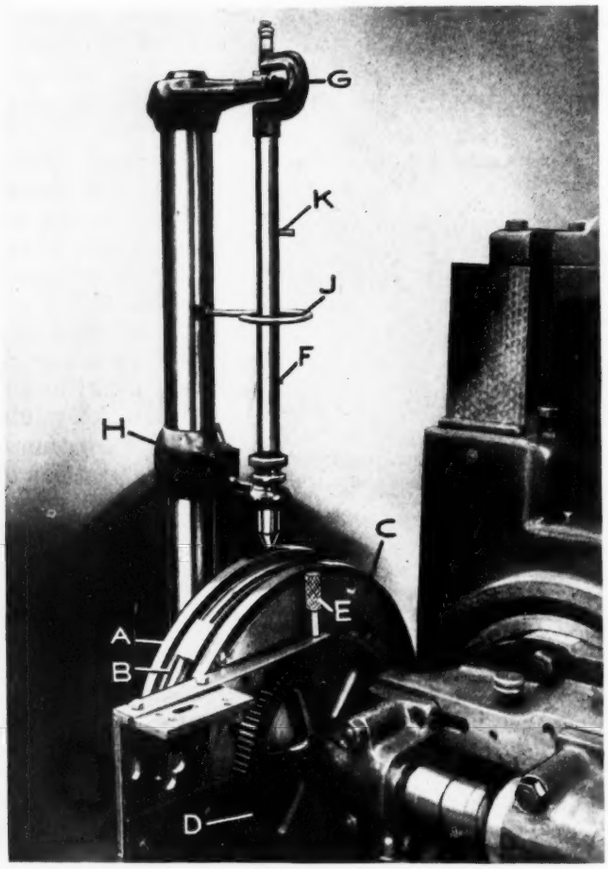
The problem was to set up the work in a convenient position, which would permit the numbering operation to be accomplished systematically and accurately with the etching tool. This was done by making use of a Gould & Eberhardt gear-hobbing machine in the manner to be described.

The spur gear *D* attached to the plate *C* is used for indexing, being controlled by the locating pin *E*.

This gear has 108 teeth, a number that is divisible by 36. The assembled auxiliary plate is carried on the outer end of the hob-supporting spindle of the machine. With both the clamping nut and the tail-block set in position, the hob-spindle is adjusted endwise to allow free rotation of the work by hand without permitting any side play that might affect the accuracy of the etching operation. As will be seen, the set-up is wholly improvised from scrap material, except for the spur gear and portable etching device attached to the work saddle of the machine.

A piece of channel iron bolted to the side of the saddle supports the etching device, the column of which is provided with a threaded end and nut. The indexing pin assembly is made of scrap channel iron parts which are attached to the circular work-table of the machine. With the work to be etched supported as described, it is possible to index it as required.

Adjustments for locating the numbers are easily made. The elevating saddle of the hobbing machine can be adjusted for proper height of the work in relation to the etching tool. The work-table which supports the indexing pin can be moved horizontally, thus locating the work through or by the indexing pin any amount desired for number spacing when two or more figures are to be etched. The indexing pin *E* is secured to a strip of flat cold-rolled stock which provides ample spring tension for indexing by hand.



Work Set-up on Gear-hobbing Machine for Numbering a Graduated Circle

The etching device itself is hand-operated. Large figures made from brass plate material are placed in the matrix support at the upper end of the column. A spring-actuated guide pin engages the figure-outline groove in the matrix. The etching tool is a simple conical-pointed hardened needle held in a cylindrical bar that has a free sliding movement within a tubular brass member *F*. This tube extends from the etching tool to the matrix bracket, terminating in a U-shaped member *G*. The matrix bracket is designed to allow the movement necessary for controlling the guide members.

The size of the numbers etched in the work can be determined by adjusting the lower bracket *H* up or down. Both the upper and lower brackets of the device are held by clamp screws. Midway of the column is a loop support *J* which serves to keep the etching tool bar within bounds when changing the guide numbers. The etching needle with its supporting cylindrical bar is pressed against the work by a spring. It is controlled by a small projecting pin *K*. A slot of ample length cut in the tube permits lifting the etching needle out of contact with the work. The pin can be dropped into an offset in the slot to insure holding the needle out of contact with the work when changing the guide numbers. A ball-and-socket arrangement of the lower bracket supports the etching tool and allows a sufficient pivoting movement for all ordinary work within the capacity of the tool.

Spinning Fixture for Assembling Die-Castings

By H. B. FAUGHT, Burbank, Calif.

The fixture shown in Fig. 1 is used in a drill press for assembling two die-castings by spinning lip *Q* of die-casting *B* over the shoulder on die-casting *A*. Adapter *C*, mounted on base *D*, is drilled in the center to clear the hub on casting *B*, and is also slotted to accommodate two rectangular-shaped bosses. The two bosses serve to keep the lower casting *B* from turning during the spinning operation.

Referring to the upper member of the fixture, main body *E* is provided with a No. 3 Morse taper shank *F*, the cylindrical end of which is pressed into body *E* and held in place by key *G*. Shank *F* carries a thrust bearing *H* and plunger pin *J*, which is retained by set-screw *K*, and is threaded to accommodate spanner nut *L* which holds the stop-member *M* in place. A 90-degree groove is cut in members *E* and *M* to provide raceways for twenty-three hardened steel balls used in the bearing at *T*.

In operation, the two castings are placed upon adapter *C*. When the upper member of the fixture is brought down, the spring-actuated thrust bearing *H* rides on top of the hub of casting *A* and the

pressure of spring *N* holds casting *A* firmly on casting *B* until the three rollers *P* (shown also in Fig. 2) spin the rim or lip of casting *B* over, as indicated at *Q*, Fig. 1. When the stop-member *M* comes in contact with the top of casting *A*, the spinning operation is completed. The ball-bearing arrangement prevents the work from being scored by stop-member *M*.

Roller-retaining pins *R* are a light press fit in member *E* and are held in place by set-screws *S*. Oil-holes are drilled in pins *R*, as shown, to conduct lubricating oil to the bearing surfaces of rollers *P*.

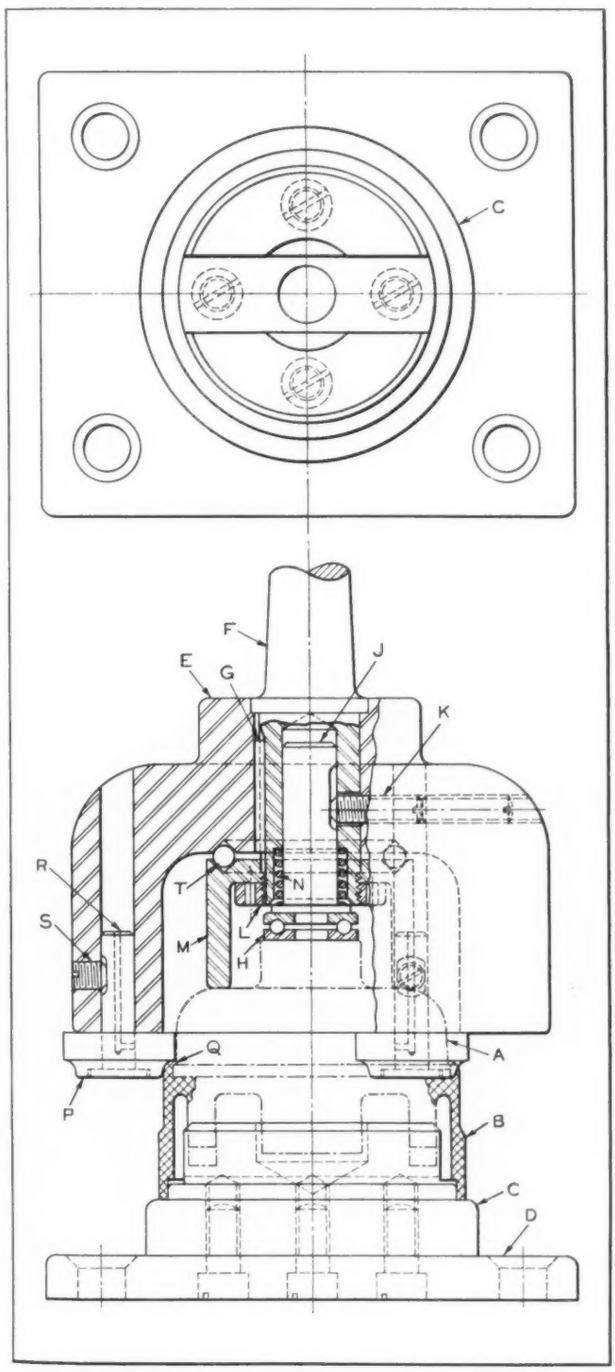


Fig. 1. Fixture Designed for Assembling Die-castings A and B by Spinning Retaining Lip at Q

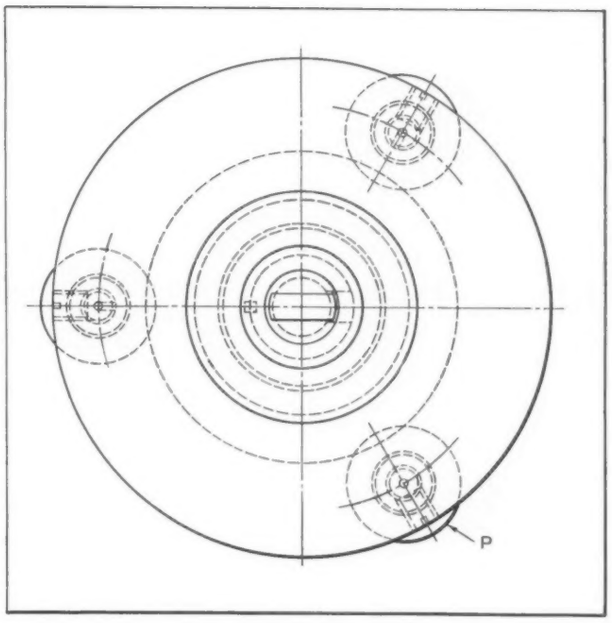


Fig. 2. End View of Member E, Fig. 1, Showing Spinning Rollers P

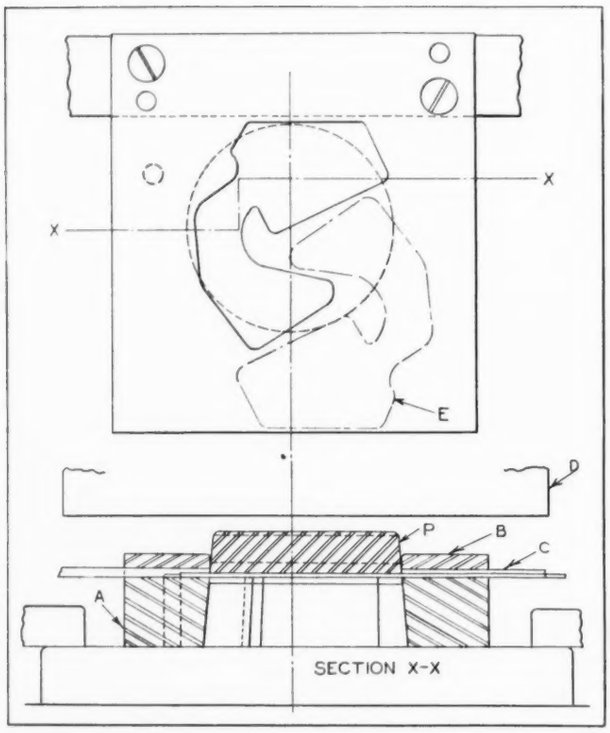
All parts of the fixture subject to wear are hardened, and rollers *P* and the face of member *E* are ground.

Blanking Die with Push-Through Punch for Experimental and Semi-Production Work

By WALTER WELLS, Newark, N. J.

The conventional idea that a punch must be clamped to the ram of the press or that the die must have some kind of shoe to secure it to the bolster was disregarded in designing the simple blanking die shown in the illustration on the next page. This die is actually an independent tool, receiving transferred power, but no guiding action, from the press. The die set is made up from material that can be found on almost any die shelf—a piece of flat stock and a discarded punch-holder.

This die is intended for the production of small quantities of blanks in cases where it is desirable to keep the tool cost as low as possible. It is especially useful in blanking out sample parts for display purposes and for use in determining how a product is likely to be received by the buying public. A die of this type is also suitable for many trial operations before building expensive production equipment. It can be used to advantage in making check-up tests on separate units of complicated mechanisms and for making all kinds of special pieces. It is also economical in cases where models may be frequently changed. In making this type of die, the toolmaker can so construct it that it can be either discarded with little loss or saved for use as the main component of a die of conventional design.



Plan View and Cross-section of Push-through Die Designed for Experimental Work

The cross-section shows the die *A* and punch *P* in their respective positions. The thickness of both these members has been greatly reduced as compared with regular diemaking practice, the punch thickness being reduced about 75 per cent. This means a distinct saving in labor and material. The die *A* rests on a cold-rolled steel plate that covers the clearance hole in the press bolster and thus serves as a pad to eliminate "cleavage" on the inner surfaces of the die. The plate may be strapped down if desired, but the die must remain free. The guide plate *B* and the spacer *C* are mounted on the die, the spacer also serving as a stock gage. The punch should not be less than 1/2 inch thick, while the combined thickness of the guide plate and spacer should be about 5/16 inch. These dimensions allow sufficient movement for most work.

The punch-holder *D* from an obsolete die set is secured to the ram, the method of operation being as follows: The stroke is adjusted by bringing the face of the punch-holder to within 1/64 inch of the top of the guide plate *B*. The stock is then introduced in the usual way. The punch *P* is next placed in its locating nest or guide plate *B*, so that it rests on the stock. The press is then tripped, causing the punch to blank out the work. The operator merely slides the die on the elevated surface of the plate to cause the blank and the punch to be lowered to the bolster surface. Finally, the die is replaced approximately under the center line of the blank and the operation repeated.

It should be noted that the top plate *B* is not a stripper, but serves merely to align the punch with the opening in the die. The contour of the opening need only approximate that of the punch. For example, in the case of the die illustrated, a hole was roughed out with a fly cutter, as indicated by the dotted circle in the upper view. The three-cornered profiles were then sawed out quickly with a band saw and finished to a close fit on the punch. The top plate *B* does not require fastening at the front of the die.

This type of die is especially adapted for double-run blanking operations where the stock is reversed for the second pass through the die, resulting in a considerable saving in material. For example, a double run in blanking pieces of the shape indicated in the illustration can be arranged to blank out the pieces in the second run, as indicated by the dotted lines. The interlocking arrangement of the blanks in this case leaves only a small amount of scrap stock.

If it is certain that only the first run of a hundred pieces produced on the die will be required, the punch and die can be made of cold-rolled steel and pack-hardened. There need be no "straight land" at the mouth of the die and no stop or gage is necessary. If it is possible that production of the blanks may be continued or if a reasonably close accuracy must be preserved, then first-class materials and workmanship must be employed. When this is done, the savings will still be considerable, as compared with the cost of a conventional die.

It may be worth while to save the main lower member of the die for future use in constructing a standard die. In such cases, clearance holes may be drilled for screws and a stop-pin included before hardening, even though they are not required for the first lot of trial blanks produced. The whole lay-out should be planned to permit the use of a regular stripper.

Modifications in the design of the top plate and punch may be necessary when the die is to be used for very small or very narrow blanks. This type of die also loses some of its special economic value when used for either extra heavy or paper-thin stock. For contours in which all corners are rounded, both the die and the punch can be band-sawed to shape from the same piece of tool steel. The saw table must be set at an angle and the line followed with even greater care than usual. The starting slot for the saw is made by drilling and broaching along the line. About 3/64 inch is allowed for the width of the profile outline on stock having a thickness of 1 inch with the work tilted to an angle of 3 degrees.

* * *

To aid in the precision testing of thermostat metals, the W. M. Chace Co., Detroit, Mich., has installed an air-conditioned room. The new installation, for summer and winter air-conditioning, uses a hermetically sealed Westinghouse condensing unit providing cooling, dehumidifying, filtering, heating, and ventilating.

Gear Manufacturers Discuss the Problems of Their Industry

THE semi-annual meeting of the American Gear Manufacturers Association, held at St. Joseph, Mich., October 16 to 18, was, in keeping with the tradition of the Association, characterized by the active standardization work of the gear industry and by the many papers of merit that were presented bearing upon the problems of the industry.

In his opening address, Charles F. Goedke, president of the Association, briefly reviewed today's conditions as they present themselves to the industry. At the same session, U. Seth Eberhardt, of the Newark Gear Cutting Machine Co., read a paper on "Experiences in the Gear Industry," containing definite suggestions relating to procedure in handling a gear-cutting shop and in dealing with its engineering, sales, and service problems. He drew upon his long experience in this line of business in presenting information of particular value as a guidance in this industry. John Hutchinson of the Chrysler Corporation read a paper on "Superfinish." In this paper he first reviewed all commonly used types of finishes, and then thoroughly covered the Superfinish process. Its relation to the gear industry was especially referred to.

Charles F. Goedke, President of the American Gear Manufacturers Association

An address by Paul Christensen, of the Cincinnati Gear Co., on "Cost Determination Not a Mystery," created a lively discussion. This paper dealt with many phases of cost determination, and laid especial emphasis on costs of single-piece production, as compared with production in quantities. Another address that created a great deal of interest was that by Professor F. A. Firestone entitled "Random Thoughts about Gear Noise." Professor Firestone has for years conducted investigations on the measurement and reduction of noise in machinery, including gear noises.

"Modern Trends in Nickel Steel and Cast Iron Gear Materials" was the subject of a paper read by C. M. Schwitter, of the International Nickel Co. Mr. Schwitter became associated with the International Nickel Co. in 1930, and has devoted several years to research work on alloy steels and nickel cast irons. His paper gave the results of his recent investigations into applications in various industrial fields from a metallurgical standpoint. A paper on "Gear Grinding" was presented by John Dixon, of the Pratt & Whitney Division, Niles-Bement-Pond Co. In this paper, the subject as a whole was reviewed and specific data on gear grinding were presented, together with numerous examples of gear grinding.

At the dinner held in conjunction with the convention, S. Wells Utley, president of the Detroit Steel Casting Co., gave an address entitled "Industry's Contribution to Civilization." This address may well be characterized as a classic contribution to clear thinking in these days of misunderstanding and misinterpretation of industry's real place in the modern state.

The Committee for Inspection and Tolerances for Gears presented a comprehensive progress report. Another complete report was presented by the Gear Lubrication Committee, together with a standardization proposal entitled "Recommendations for Industrial Gear Lubrication." Numerous other committees made progress reports.

* * *

John Huntington Institute to Continue Welding Courses

Recognizing the need for training in the fast growing welding field, the John Huntington Polytechnic Institute of Cleveland, Ohio, announces a continuation of the five-day courses in arc-welding design and practice which it has sponsored in collaboration with the Lincoln Electric Co., of Cleveland. These courses offer engineers and designers the opportunity of studying intensively the redesign of products and structures for arc-welded construction, and also cover welding procedure and technique. They are to be given in Cleveland during the weeks beginning October 30, December 4, January 8, February 12, March 25, April 22, and May 27.

Some of the Exhibits at the National Metal Exposition

IT would not be possible in a limited space to mention all the exhibits of the more than two hundred exhibitors who were represented at the National Metal Exposition in Chicago, October 23 to 27. However, a brief review of a few of the exhibits of new and unusual equipment and materials may prove of interest.

The Linde Air Products Co., New York City, presented a review of recent developments in the applications of the oxy-acetylene process and "Unionmelt" welding, as well as an extensive display of apparatus and equipment, including various types of stationary, semi-portable, and portable oxy-acetylene cutting machines. One section of the exhibit was devoted to the flame-hardening process for producing a hard wear-resisting surface on iron and steel parts.

A new electric furnace for the bright-hardening of tool steel was shown in operation in the exhibit of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This electric furnace employs an atmosphere known as "Ammogas," which is so inactive with carbon that a soft skin does not form on a 1.5 per cent steel soaked in it at 1850 degrees F. for an hour. When hardened, the tool or die has a bright clean surface that is as hard as the underlying metal. This company also demonstrated phos-copper brazing by the electric arc.

Some phases of the operation of a newly developed Bessemer flame control, said to be the first scientific regulation of the Bessemer steel-making process, were demonstrated by the Jones & Laughlin Steel Corporation, Pittsburgh, Pa. A scale replica of the Jones & Laughlin pilot plant laboratory, with models of experimental open-hearth furnaces, rolling mills, and other steel-making and finishing equipment, was another exhibit of especial interest.

Supplementing a display of the more commonly known uses of Carboloy cemented carbide for cutting tools, drawing and sizing dies, and diamond-impregnated wheel-dressers, the Carboloy Company, of Detroit, Mich., featured an exhibit showing the diversified uses of Carboloy as a wear-resistant insert on machines and parts subjected to rapid abrasive wear. To those familiar principally with the use of Carboloy as a cutting tool in the metal-working industries, its application in the oil, textile, food, paper, radio, sporting goods, and paint industries was of unusual interest. To indicate the life of Carboloy, compared with other wear-resisting metals, the results of working tests were reported.

The importance of adding chromium to steels and irons to increase their resistance to heat, corrosion, and abrasion, and to enable them to meet rigid industrial requirements of high strength and uniform hardness was demonstrated at the exhibit of the Electro Metallurgical Co., New York City. Various uses and advantages of chromium-bearing alloys in industry were emphasized, and many parts made from such alloys were on display.

The latest developments in arc welding were included in the exhibit of the Lincoln Electric Co., Cleveland, Ohio. Several new Lincoln products that broaden the application of welding were shown for the first time, including new and improved arc-welding generators and a number of new arc-welding electrodes. A new Lincoln 200-ampere vertical machine, a 200-ampere belted unit, a handy size 150-ampere machine fitted with dual continuous control, and a gasoline-engine-driven welder were on display.

The unusual corrosion resistance and wear resistance of Haynes Stellite, Hascrome, and Hastelloy alloys were featured in the exhibit of the Haynes Stellite Co., New York City. Various types of valves used in steam installations and internal-combustion engines were on display, with cutaway sections to show typical applications of Stellite hard-facing alloys used to increase the resistance of valve-seats and valve-seating surfaces to corrosion, scoring, seizing, and galling. Stellite metal-cutting tools were also on display; an interesting demonstration was made of the exceptional red-hardness of Stellite J-Metal.

The exhibit of E. F. Houghton & Co., Philadelphia, Pa., featured a demonstration of the company's new rapid liquid carburizer known as Perliton No. 45. This product is said to be at least 20 per cent faster in carbon penetration than the regular Perliton liquid carburizer, and is particularly adapted for short heats on production runs where speed is essential. Other products displayed included an anti-scaling compound of interest to users of steel pots, the life of which is prolonged by the application of this material, and Houghto-Black, a blackening salt which can be used below the tempering temperature range to blacken steel parts.

The exhibit of the Air Reduction Sales Co., New York City, featured demonstrations of automatic welding, bronze welding, flame hardening, flame cutting, flame cleaning, and several commercial applications of the oxy-acetylene flame. The Planograph, a new addition to the company's extensive line of flame-cutting machines, was demonstrated for the first time. Bronze welding with rods coated with a new non-flaking flux was demonstrated. These new coated bronze rods insure the operator of strong sound welds.

The Wilson Welder & Metals Co., Inc., New York City, featured in its exhibit the "Hornet," a recently introduced single-operator motor-generator arc welder which was demonstrated, together with the company's complete line of arc-welding equipment.

The Steel and Tube Division of the Timken Roller Bearing Co., Canton, Ohio, presented an instructive eight-minute motion picture on the making of Timken steel, with the recorded voice of a commentator explaining the picture. Timken tool and die steels also had a prominent part in the company's exhibit.

A production brazing job was part of the demonstration of the exhibit of Handy & Harman, New York City. Compressor valves fluxed for brazing were loaded on a traveling belt and brazed with Easy-Flo alloy, cleaned, and cooled at the rate of five joints per minute. There was also a welding table on which demonstrations were made of the use of the brazing alloys Sil-Fos and Easy-Flo on a wide variety of ferrous and non-ferrous metals.

Tool Engineers Meet in Cleveland

THE American Society of Tool Engineers held its semi-annual meeting in Cleveland, October 6 and 7. The first day was devoted to plant visits. Several tours were arranged, including visits to the plants of the Acme Machinery Co., the White Motor Co., the Cleveland Graphite Bronze Co., the National Acme Co., the Parker Appliance Co., the National Screw & Mfg. Co., and the Republic Steel Corporation.

In the evening, a dinner meeting was held, presided over by James R. Weaver of the Westinghouse Electric & Mfg. Co., who is president of the Society. John Younger, professor of engineering, Ohio State University, who is chairman of the Society's Fact-Finding Committee, gave a second report of that Committee on the subject "The Effect of the Development of the Machine on Employment and on the Standard of Living." In this report, a great many important facts were brought out showing how the development of the machine has benefited not only the population of the nation as a whole, but the workers themselves by making possible shorter hours, less laborious working conditions, higher wages, and lower prices.

Hamilton Fish, Congressman from the state of New York, made an address at the meeting entitled "Economic and Political Effect of the Development of the Machine." The major part of the address of Mr. Fish, however, was devoted to a review of political conditions in their relation to the war in Europe.

Saturday morning, October 7, was devoted to a technical session, at which a number of papers were presented, all of which created unusual interest and discussion. G. J. Hawkey, chairman of the Cleveland Chapter of the Society, presided at the meeting, which actually was a symposium on bearings. Stanley R. Thomas, chief engineer, Bantam Bearings Corporation, South Bend, Ind., presented a paper on "Application and Use of Anti-Friction Bearings as Applied to Machine Tools"; Eugene Bouton, supervisor of time study, J. I. Case Tractor Works, Racine, Wis., read a paper on "Application and Use of Plain Bearings as Applied to Machine Tools"; Karl L. Herrmann, engineer, South Bend, Ind., discussed the subject "Bearings —Their Use and Misuse."

James R. Weaver, of the Westinghouse Electric & Mfg. Co., President of the Society

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Remarkable Growth of Plastics Industries

Within recent years there has been a tremendous increase in the production of plastic materials. According to the 1937 census, approximately $78,000,000 worth of plastics and plastic products were produced in that year. This was an increase of 55 per cent over 1935 and more than 200 per cent over 1933. In 1939, the value of plastics produced reached $100,000,000.

As a definite indication of plastics progress during the past year, the fourth annual Modern Plastics Competition, sponsored by *Modern Plastics*, reveals literally hundreds of new uses of plastics. An exhibition of the entries in the Modern Plastics Competition will be open daily from 10 A.M. to 4 P.M. (except Saturdays, when it closes at noon) until December 15 in the Chanin Bldg., 122 E. 42nd St., New York City. Awards to the winners in the competition will be made on November 14 at the presentation dinner at the Waldorf-Astoria Hotel, New York City.

Condensed Review of Some Recently Developed Materials

Arranged Alphabetically by Trade Names

Class of Material	Trade Name	Properties	Applications
Die Steel	**Airkool**	A die steel with performance characteristics intermediate between those of high-carbon high-chromium and oil-hardening types. It is air-hardening, wear-resistant, and has non-deforming properties. It is hardened by cooling in air from a temperature between 1750 and 1850 degrees F.; it is tempered to from 63 to 58 Rockwell C. by drawing at temperatures from 300 to 1000 degrees F.	Suitable for applications where toughness and wear resistance are the principal requirements.
Synthetic Plastic	**Bakelite Polystyrene**	A thermoplastic molding material that was primarily developed for use as an electrical insulator. Tests made indicate that no noticeable changes occur in the electrical properties of the material with an increase in either temperature or humidity. Tensile strength, from 5000 to 5500 pounds per square inch; impact strength, from 0.14 to 0.16 foot-pound.	Since the material was developed primarily as an electrical insulator, it offers marked advantages for use in many electrical products and equipment.
Malleable Iron	**Belmalloy**	A pearlitic malleable iron having physical properties developed by an electric melting and continuous annealing process that are similar in many respects to the properties of 0.40 per cent carbon cast steel. The tensile strength ranges from 70,000 to 80,000 pounds per square inch; yield point, from 45,000 to 50,000 pounds per square inch; and hardness, from 179 to 207 Brinell. Can be machined more easily than steel castings, although not so easily as regular malleable-iron castings.	Suitable for applications where high tensile strength, considerable hardness, comparative ease of machining, and freedom from internal stresses are of particular value in castings.
Cellulose Plastic Coating	**Cellucraft**	A plastic coating for metal, wood, and rubber, applied by spray guns; available in bright colors, pastel shades, "metal tones," and other effects, obtained by pigmenting the coating material. A similar material known as "Macoid" is applied by dipping.	Applicable to the finishing of automobile hardware, such as window regulators, door handles, and control knobs; die-castings in general; and molded rubber steering wheels.
Light Non-ferrous Metal	**Colalloy**	A metal of silvery appearance having only one-third the weight of steel. It has outstanding electrical and thermal conductivity, is unusually resistant to corrosion, and has great strength. It can be easily worked, formed, and shaped.	Suitable for articles employed in the food industries, such as containers, pans, and trays. It is adapted for use in chemical and paint manufacturing plants, oil refineries, breweries, distilleries, rubber plants, paper mills, etc.
Heat-insulating Cement and High-temperature Blocks	**Coprtex**	Heat-insulating cement made from a base material of resilient long-fiber copper slag wool. The cement will bond and stick to clean surfaces of any type of material. Average adhesive strength, 30 pounds per square inch. It will withstand a temperature of 2000 degrees F. The high-temperature Coprtex blocks weigh 22 pounds per cubic foot; their maximum temperature limit is 1800 degrees F.	The cement is suitable for making repairs or changes in steam lines, headers, boilers, or similar equipment. High-temperature blocks may be used where superior insulating efficiency is required.
Corrosion-preventive Compound	**Corol**	A rust-preventive preparation which may be sprayed on metal parts or in which the parts may be dipped to prevent corrosion. Can be applied to metal surfaces even when they are damp, as it will displace any water that may be present. Can be easily removed.	Used by manufacturers of airplanes to prevent corrosion on metal parts, especially when exposed to dampness and sea air; particularly suitable for metal parts to be exported.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Alloy Resembling Hardened Copper	**Cupaloy**	An alloy that can be obtained with elastic strength of 35,000 pounds per square inch and with remarkable heat and electrical conductivity characteristics. Withstands temperatures of 750 degrees F. with relatively little permanent softening. Rate of wear under severe tests is only 40 per cent of that of hard-drawn copper.	Used in making continuous welds that are unusually strong and gas-tight, as in welding streamline trains, cooling systems for electric refrigerators, etc. When used for welding tips, the alloy has a service life several times longer than that of pure copper, and from 50 to 200 per cent longer than that of other low-resistance alloys.
Corrosion-resisting Alloy	**Durco KA2S**	An 18 per cent chromium, 8 per cent nickel, low-carbon steel developed for its corrosion-resisting properties.	Suitable for handling nitric and fruit acids.
Corrosion-resisting Alloy	**Durco KA2SMo**	An 18 per cent chromium, 8 per cent nickel, 3 per cent molybdenum, low-carbon steel developed for its corrosion-resisting properties.	Suitable for handling pulp cooking liquids and phosphoric acid.
Synthetic Plastic	**Durez 38-443**	Asbestos-filled molding material having a compressive strength of 28,000 pounds per square inch and a specific gravity of 1.8.	Developed to meet the Underwriters' specifications for withstanding 200 degrees C. (392 degrees F.) for 72 hours.
Synthetic Plastic	**Durez 38-646**	Asbestos-filled molding compound with unusually low specific gravity—1.59. Compressive strength, 28,000 pounds per square inch; flexural strength, 9000 pounds per square inch.	Suitable for resisting temperatures up to 500 degrees F.
Corrosion-resisting Alloy	**Durimet**	A nickel-chromium-molybdenum low-carbon steel having corrosion-resisting properties for the handling of corrosive liquids.	Used for all parts that come in contact with such corrosive liquids as weak sulphuric and other acids, chlorine bleach solutions, and caustics.
Corrosion- and Wear-resistant Alloy	**Duronze**	An alloy of high resistance to wear and corrosion, composed of aluminum, copper, and silicon, with a tensile strength of 90,000 pounds per square inch.	Developed for the manufacture of valve bushings for valves that must operate satisfactorily at high pressures and high temperatures without lubrication.
High-strength Flat-rolled Steel	**Dyn-El**	A high-strength flat-rolled steel with unusual capacity to resist fatigue, impact, and corrosion. Can be produced at low cost. Permits safe working loads of 25,000 pounds per square inch. Elastic limit, 58,000; tensile strength, 72,000 pounds per square inch; elongation in 2 inches, 28 per cent; and reduction of area, 60 per cent.	Suitable for railroad rolling stock, permitting reduction in dead load at no decrease in strength or service life; for trucks, buses, and other automotive equipment, to obtain reduced weight, with increased strength; and for stationary structures, to obtain increased strength, longer life, and resistance to corrosion.
Brazing Alloy	**Easy-Flo**	A low-temperature brazing alloy having a medium silver content, which produces a high-strength bond with great ductility, making assemblies made with it gas-tight in service.	Suitable for making reliable joints between unlike metals, as, for example, for joining steel, copper, and non-ferrous alloys.
Monel Metal	**Ebonized Monel**	Monel metal with an ebony finish obtained through an oxidizing operation. The metal is identical with regular Monel except for the lustrous blue-black finish. It is immune to rust and resists discoloration at relatively high temperatures.	Suitable for applications where appearance must be maintained at temperatures up to 1400 degrees F., as in reflectors, deflectors, element pans, etc., of electric heating units.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Refractory Furnace Material	**Firecrete, Light-Weight**	A light-weight material from which any refractory shape can be obtained quickly by simply mixing it with water and casting it in a form. After being in the form twenty-four hours, the shape is ready to be placed in service. Sixty-five pounds of material are required for each cubic foot of finished construction.	Suitable where difficult brick construction is encountered, for lining furnace doors, and for making small monolithic linings. Can be subjected to working temperatures up to 2200 degrees F. Especially advantageous in the case of intermittently operated furnaces, because of its exceptionally low heat storage capacity.
Weld Spatter Prevention Coating	**Flash-Ex**	A metal coating eliminating the necessity of grinding or chipping weld spatter from the metal surrounding a weld. The white and pigmented coating prevents the adhesion of spatter to the welded parts, dies, or welding-holder jaws. After the welding operation, any spatter is merely brushed off.	This metal coating is used in resistance welding to prevent the dies and welding-holder jaws from becoming jammed due to spatter.
Magnet Wire	**Formex**	Magnet wire insulated with a synthetic resin which is tougher and more flexible than ordinary enamel coatings and which takes up much less space. The electrical properties are as good as those of ordinary enameled wires, with higher resistance to abrasion. When severely twisted and then subjected to a temperature of 260 degrees F. for one hour, ordinary enameled wire cracks, while Formex wire is not affected.	This new type of insulation has been found to have improved qualities in the actual manufacture of many electrical products. It gives the designer an opportunity to reduce the size of many products of which this wire is an integral part.
Cleaning Compound	**Galvo-Cleen**	This compound forms a bond that enables newly galvanized metal to be painted without a primer, the compound providing a non-reactive zinc-phosphate coating.	Galvanized metal, zinc die-castings, and alloys having a large percentage of zinc can be cleaned and prepared for painting by the application of this compound.
Preparation Preventing Adhesion of Weld Spatter to Metals	**Glyptal No. 1294**	A preparation that is preferably sprayed rather than brushed on work to be welded, and can be applied without harm to any metal surface, including polished stainless steel. On surfaces that are to be painted, it serves as an excellent priming coat.	Used for preventing the adhesion of weld spatter to metals that are to be welded. It will not make the weld hard or brittle.
Nickel-Chromium Alloy	**Illium-R**	A corrosion-resistant alloy from which strip, welded tubing, and cold-rolled rods are produced having, when work-hardened, a tensile strength ranging from 140,000 to 150,000 pounds per square inch. In an annealed condition, the tensile strength is from 95,000 to 105,000 pounds per square inch. Brinell hardness, work-hardened, from 340 to 365; annealed, from 175 to 240. The alloy is of approximately the same machinability as stainless steel.	Strip stock of Illium-R is available in a number of widths and lengths and in gages from 8 to 34; adapted for drawing, perforating, stamping, and other fabrication methods. Rolled rod is suitable for tie-rods, light shafting, screw machine stock, and small hardware.
Wear-resisting Alloy	**Kennametal**	A tungsten-titanium-carbide compound having great wear and corrosion resistance and strength. In one instance, where it was previously necessary to change as many as seven valves in twenty-four hours, Kennametal-tipped valves and seats gave such service that only one valve had to be replaced every one or two weeks.	Suitable for pump and other valves that are subject to unusual abrasive or corrosive action. Balls and seats of this material for oil-well pump valves have demonstrated their value in severe tests.
Acid-, Oil- and Water-resistant Paper	**Koroseal-coated Paper**	A paper coated with a thin layer of Koroseal, a rubber-like substance impervious to deteriorating fluids and gases. The coated paper is resistant to acid, oil, water, air, and light.	Offers protection for exposed surfaces of machinery while in ocean transit, since coverings can be made from it which will exclude the salt sea air.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Free-cutting Steel	**Ledloy**	A steel in which lead is uniformly distributed throughout in such a fine state of dispersion that it cannot be seen under a microscope. In this form it has no effect on the physical properties of the steel, but makes it much more free-cutting. Ledloy 1120, for example, is said to machine from 30 to 60 per cent more easily than standard S A E 1120. Lead is added in amounts of 0.15 to 0.30 per cent.	Important savings can be effected in the machining time of a large variety of parts such as gears, crankshafts, spindles, spline shafts, etc. The steel is available in all hot-rolled forms, and is also cold-finished by leading producers of cold-drawn steel.
Bonded Stainless Steel	**Ludlite**	A composite product consisting of an outer surface of thin stainless steel permanently bonded to a backing of tough, flexible, non-metallic material. The backing material makes it possible to cement Ludlite to plaster, wood, fiber board, and concrete. Produced in rolls 2 feet wide, and in lengths from 50 to 100 feet, as well as in tiles 4 inches square.	Suitable for lining bins and boxes, for insulating refrigerators, for trimming and covering automobile running boards, etc.; also applicable in the construction of stainless-steel sinks, shelves, and drain-boards, and for decorative purposes.
Cellulose Plastic Coating	**Macoid**	A plastic coating for metal, wood, and rubber, applied by dipping; available in bright colors, pastel shades, "metal tones," and other effects, obtained by pigmenting the coating material. A similar material known as "Cellucraft" is applied by spray guns.	Applicable to the finishing of automobile hardware, such as window regulators, door handles, and control knobs; die-castings in general; and molded rubber steering wheels.
Alloy Steel	**Mayari R**	Low-alloy structural steel developed with a view to combining strength, good hot- and cold-working properties, good welding characteristics, little tendency to harden on rapid cooling, and high resistance to atmospheric corrosion. Has a minimum tensile strength of 65,000 pounds per square inch, and a minimum yield point of 50,000 pounds per square inch. Is about six times as corrosion-resistant as ordinary structural steel. Contains small percentages of chromium, nickel, and copper.	Suitable for any purpose where ordinary structural steel is employed, but where the increased strength, better welding characteristics, and higher resistance to corrosion are especially desirable.
High-strength Cast Iron	**Meehanite, Super A**	High-grade cast iron in which copper is used as an alloy metal, developed to provide a great increase in hardness and wearing qualities, while at the same time being easily machinable. Super A Meehanite with a hardness of 269 Brinell can be machined 20 per cent faster than regular alloy cast iron of 207 Brinell. Tensile strength, over 50,000 pounds per square inch.	Particularly well adapted for use in the construction of internal combustion engines and marine cylinders; also used in the manufacture of large gears, piston-rings, and other parts subjected to severe wear.
High-strength Cast Iron	**Meehanite, Super WH**	An alloy that is unusually wear-resistant and that has a well balanced combination of physical properties. Can be made with a hardness up to 578 Brinell.	This type of Meehanite cast iron has been found especially suitable for castings subjected to extremely severe wear, such as ball-mill liners, muller tires, and pan bottoms.
Rubber Lining for Tanks	**Multi-Ply**	Liquid rubber which is applied in laminations to the sides of metal tanks to be coated until the desired thickness is obtained. These several coats coalesce during the vulcanizing process into a single sheet, bonded or almost "welded" to the walls of the tank.	Especially applicable to plating and chemical tanks. Provides a continuous, seamless, lap-free, and unbroken lining.
Nickel-iron Alloy	**Nilvar**	A nickel-iron alloy that has the lowest coefficient of expansion of any metal at temperatures up to 392 degrees F.	Suitable for applications where dimensions must be maintained at varying temperatures, as, for example, in rotor and stator plates of variable condensers in ultra high-frequency radio equipment, bimetallic strip, and length standards.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Baking Enamel	**Platelustre (Baking)**	A baking enamel by means of which any polished metal can be made to resemble brass, aluminum, or steel. Flat stock finished with the enamel can be formed after baking. The enamel can be applied to polished metal by spraying or roller-coating.	Especially suitable for use in the manufacture of lighting fixtures, compacts, novelties, and other products on which a brilliant metallic finish is desirable.
Gray Cast Iron	**Pomoloy**	An unalloyed cast iron having a tensile strength of 40,000 pounds per square inch and a hardness of 215 Brinell; it is dense and corrosion-resistant. The high physical properties are obtained by a careful control of the materials used and of the foundry processes rather than by the addition of alloys. Pomoloy is easily machined. The machined surfaces can be highly polished and the iron can be hardened by heat-treating methods and by the oxy-acetylene process.	This cast iron is now used in pump manufacture, but is applicable wherever a high-grade plain gray iron of high tensile strength serves the purpose.
Metal Cleaner	**Quaker TF-936**	A water-soluble hydrocarbon for use in cleaning metals. Particularly effective for removing mineral oils, fatty substances, and soap.	Compound can be used for removing all types of cutting, slushing, and quenching oils from machine parts. Also serves to rustproof work for a short period of time.
Flexible Tubing	**Resistoflex**	Tubing made in sizes up to and including 1/2 inch inside diameter, from a flexible synthetic resin, insoluble in gasoline, oil, ether, and alcohol. Has extreme lightness (weight about one-half that of aluminum), great toughness and strength, good elasticity, and a high degree of flexibility.	Used chiefly in fuel and brake lines; in lubrication systems for automotive equipment, Diesel engines, and aircraft; in chemical and process industries for conveying solvents and oils; in hydraulic lines; and in fuel and oil handling equipment.
Protective Coating	**Seal-Cote**	A transparent protective metal coating that withstands the action of sunlight, moisture, and climatic changes. The coating can be spread or brushed on the metal surface. It is claimed to have preserved the original finish of metal parts when exposed to weather for a period of six months.	Recommended for use on copper, brass, bronze, and steel, as well as on other metals subjected to outdoor exposure, moisture, etc.
Weld Spatter Prevention Coating	**Spatter-Ex**	A metal coating to obviate the grinding or chipping of weld spatter from the metal surrounding a weld. The transparent jelly-like coating prevents the adhesion of spatter. After the welding operations have been completed, any spatter on the surrounding surfaces is merely brushed off.	The compound is especially applicable to arc, flash, or butt-welding operations.
Oxidation-resisting Steel	**Stayblade Max**	Will resist oxidation in air and steam up to temperatures as high as 1650 degrees F. Said to be easily machinable. Contains high percentages of chromium and nickel, as well as titanium and aluminum.	Intended for boiler drums, turbine casings, high-temperature reaction vessels, and other equipment operating at high temperatures and under great stress. Also used for blades in high-temperature turbines.
Die Material	**Strenes Metal**	A chromium-nickel-molybdenum alloy that can be cast to shape, eliminating a large amount of machine work and stock removal. Up to 500 hours of machining time has been saved by the use of this metal for a single large die. In the plant of a refrigerator manufacturer, dies from this metal are said to have produced more than 1,350,000 refrigerator top stampings from 0.050-inch material.	Suitable for drawing and forming dies, punches, forming pads, and draw- or pressure-rings.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Cast Steel	**Telastic Moly**	A manganese-molybdenum alloy steel containing from 0.15 to 0.20 per cent molybdenum. Gears 16 feet in diameter weighing 53,000 pounds each, as cast, show when annealed, normalized, and drawn, a tensile strength of 80,000 pounds per square inch, a yield point of 45,000 pounds per square inch, an elongation in 2 inches of 23 per cent, a reduction in area of 40 per cent, and a Brinell hardness of from 160 to 190.	Suitable for castings where great strength and reliability are required; has been applied to gears for speed reducers of moderate size; for rolling mill drives; and for geared power transmissions involving 1000 horsepower or more.
Wear and Rust Prevention Coating	**Thermoil-Granodine**	A coating material developed to prevent wear and rust of machine parts. Applied by immersing the machine parts, after thorough cleaning, in a boiling solution of the coating material. The solution transforms the surface into a layer of iron and manganese phosphates, which becomes an integral part of the metal beneath.	Suitable for treating automobile engine parts, such as pistons, valves, and camshafts; gears; and any machine parts having bearing surfaces.
High-speed Steel	**Van-Lom**	A molybdenum high-speed steel containing from 0.78 to 0.83 per cent carbon, 2 per cent vanadium, 4.1 to 4.4 per cent chromium, and 8.75 to 9.25 per cent molybdenum.	Used for cutting tools. Unusual cutting properties are claimed for this steel, as well as uniformity in heat-treatment.
Rolled Zinc	**Zilloy**	A rolled zinc possessing greater strength than heretofore available in commercial grades. It is stiffer and stronger, and has greater heat resistance than the commercial grades of rolled zinc, but possesses the same corrosion-resistant characteristics. Fabricated and finished by similar methods to those used for commercial grades.	Suitable for fabrication into screen frames, screen guides, splines, weather-strips, corner beadings and modings, as well as for zinc stampings of greater strength than obtainable from commercial grades of rolled zinc.
Galvanized Iron and Steel Sheets	**Zincgrip**	Galvanized iron and steel sheets with a heavy coating of commercially pure zinc that will not crack or peel during drawing or forming operations. Has from 50 to 75 per cent more protective zinc than the "Tight Coat" sheets generally used in making fabricated products.	Suitable for shapes and stampings made by cold-drawing and rolling processes. Refrigerator water-shed pans have been successfully drawn to a depth of 5 inches with the zinc coating intact. Also suitable for spiral corrugated lock-seam drainage pipe and roof drainage parts.
Compound Applied before Lacquering or Enameling	**Zinsol**	A solution or compound which, when applied to metal surfaces, forms a surface that is chemically inert to moisture, the atmosphere, and organic finishes, so as to form a stable foundation for any desired finish.	Used for treating the surfaces of zinc, zinc-coated, or galvanized products before finishing them with lacquer, enamel, paint, or varnish. The zinc or zinc-coated products are dipped into or wiped with the solution.
Laboratory Combustion Tubes	**Zircofrax**	Tubes, combustion "boats," and covers, made from zirconium silicate, for use in steel and alloy manufacturing plant laboratories. The "boats" and covers will withstand temperatures up to 2820 degrees F., and the gas-tight tubes over 2900 degrees F.	Applicable for laboratory equipment at temperatures well above those required in the analysis of steels and alloys with high melting temperature.
Nickel Alloy	**Z-Nickel**	A nickel alloy containing 98 per cent nickel, which has the corrosion-resistant properties of nickel combined with the mechanical properties of high-strength alloy steel. It has been produced with a tensile strength as high as 250,000 pounds per square inch, and a hardness as high as 46 Rockwell C. Commercial cold-rolled strip, unhardened, varies in tensile strength from 90,000 to 155,000 pounds per square inch, and heat-treated strip from 120,000 to 220,000 pounds per square inch.	Has been applied to the manufacture of hand tools, wire brushes, spring clamps, helical springs, and electrical parts. It is commercially produced in the form of hot- or cold-rolled strip.

Tocco Hardening Adopted for Jacobs Chucks

THE Tocco process of localized surface hardening was developed several years ago by the Ohio Crankshaft Co., Cleveland, Ohio, and has become well known because of its successful application in the automotive and tractor industries, where it is being used to harden crankshafts, camshafts, drive-shafts, axle shafts, valve tappets, rocker-arm shafts, track pins, and other parts. This process has now been applied in an entirely different industry by the Jacobs Mfg. Co., Hartford, Conn., for a local hardening operation on drill chuck bodies.

Only the nose of the chuck body, including the key or wrench pilot holes, is hardened, as only this area is subject to wear. Previously the entire front end of the chuck body was heated, in order to harden the desired area. The irregular cross-section of the body, which may be seen in Fig. 2, created serious distortion of the jaw sockets when the former hardening method was employed, making it difficult to obtain the required accuracy in the finished chuck. As a result, there was a high percentage of rejected bodies at the time of inspection.

Fig. 1. Equipment Used in the Tocco Hardening of Bodies for Jacobs Chucks

With the Tocco method, the heat is confined to the area that is to be hardened; thus, the jaw sockets are not heated, there is no distortion, and the wearing surfaces are more uniformly heat-treated, are harder, and have a longer life. Rejections due to distortion or insufficient hardness have been entirely eliminated, resulting in substantial savings. In addition, the actual production costs for the hardening operation have been lowered, as compared with the previous method.

Hardening of the Jacobs drill chuck bodies is now performed in the Tocco Junior hardening machine shown in Fig. 1, which is designed to be set in production lines, so as to eliminate handling between the machine line and the heat-treating department. Localized heating for hardening by

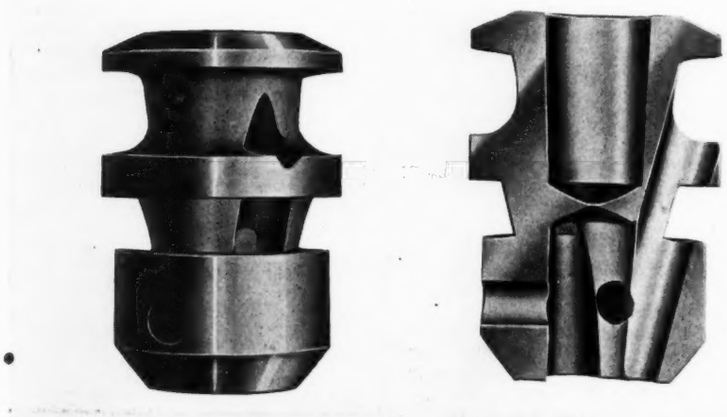

Fig. 2. Illustration Showing the Irregular Cross-section of Jacobs Chuck Bodies, which Caused Serious Distortion when the Bodies were Hardened by the Method Previously Employed

the Tocco process is accomplished by subjecting the area to be hardened to a high-frequency magnetic field, which is produced by the passage of high-frequency current through an inductor coil that surrounds but does not touch the work.

The high-frequency magnetic field causes heating in the desired area by the combined heating effects of hysteresis and eddy currents. Another phenomenon accompanying the use of high-frequency current is that heating is confined to the skin or surface of the work. The source of the high-frequency current used in this process is a special converter which is built into the machine and operated from the ordinary shop power supply.

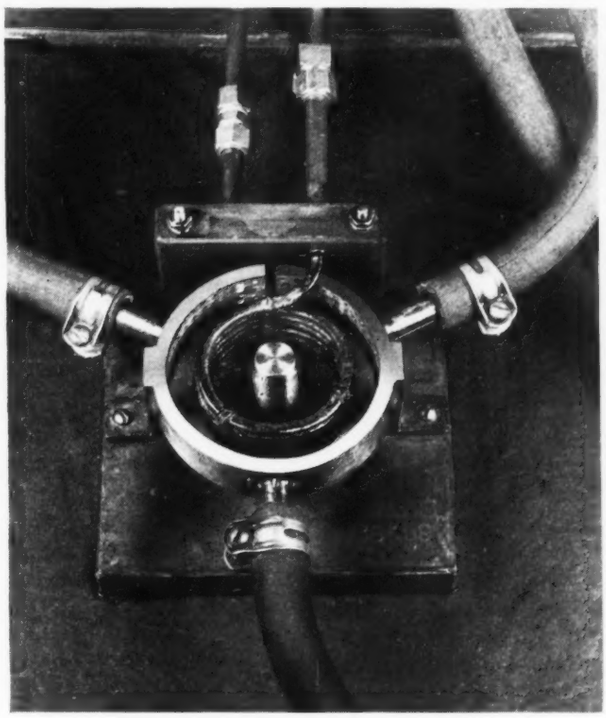

Fig. 3. Close-up View of the Inductor Coil, within which the Chuck Bodies are Placed for Hardening, and of the Surrounding Quenching Jacket

This heating rarely requires more than a few seconds. As soon as the area to be hardened has reached the desired temperature, the power is automatically shut off and the heated area is quenched by spraying water under pressure through orifices in a surrounding jacket. Quenching is accomplished, of course, without moving the work.

In the hardening of Jacobs chuck bodies, the operator places a body over the post in the center of the inductor coil, as shown in Fig. 4, and pushes a button to start the hardening cycle. During this process, a 250,000-cycle current passes through the coil and heats the chuck body to 1450 degrees F. After the body has been automatically quenched, the operator removes the hardened chuck body and inserts another for heat-treatment. Heating and quenching are automatically controlled within an accuracy of plus or minus 0.05 second. The power input, length of heating, quenching pressure, and time of quenching are all preset, thus insuring accuracy of heat-treatment and duplication of results.

By the Tocco process, the chuck bodies are hardened to Rockwell 64 on the C scale, and they are given a metallurgical structure that is highly resistant to wear and abrasion.

In order to handle various sizes of chuck bodies, it is only necessary to change the inductor coil, which involves the disconnection and connection of three hose lines and two electrical leads. The

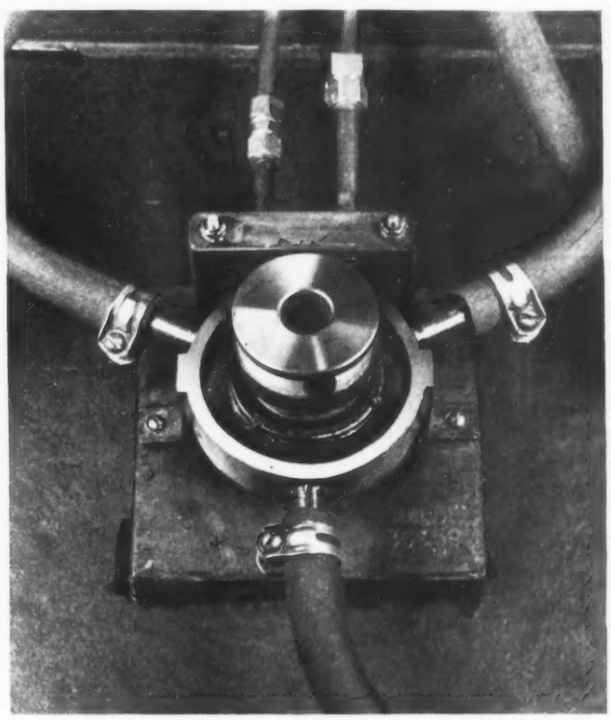

Fig. 4. View of a Drill Chuck Body within the Inductor Coil, and Positioned over a Post, for Localized Hardening by the Tocco Process

predetermined hardening factors are then set on control disks, after which the machine is ready for operation on the new part. The complete change can be made within five minutes.

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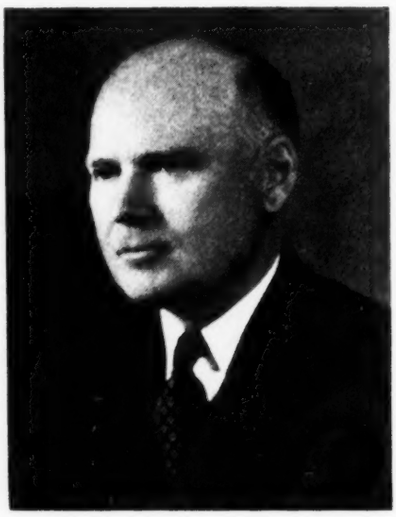
Gear Industry Indicates Industrial Activity

The American Gear Manufacturers Association, 602 Shields Bldg., Wilkinsburgh, Pa., reports that the gear sales for September were over 31 per cent above those for August, and 56.5 per cent ahead of those for September, 1938. The nine months ending with September, 1939, showed a gain of over 25 per cent, compared with the same period last year.

Machine Tool Builders Hold Annual Meeting

THE thirty-eighth annual convention of the National Machine Tool Builders, held in Cleveland, Ohio, October 2 and 3, was attended by a larger number of members than any recent convention. Many of the important problems now facing the industry were thoroughly discussed.

The retiring president of the Association, Wendell E. Whipp, president of the Monarch Machine Tool Co., in his address "Charting a New Course," dealt with the conditions created in the machine tool industry by the war in Europe. He emphasized that, in spite of whatever business may come from Europe as a result of the intensified activity in the industries there due to the war, the future of the American machine tool industry is interwoven with that of America's domestic manufacturing enterprises; and the lasting and permanent market for American machine tools lies in this country.



J. E. Lovely, of the Jones & Lamson Machine Co., New President of the Association

"It may be very tempting," said Mr. Whipp, "to take the fullest possible advantage of the sudden war-created foreign demand; but if that demand is fulfilled at the expense of American industry, the price that inevitably must be paid will be heavy. . . . It seems to me, therefore, highly necessary that we guard ourselves against the danger of succumbing to the false philosophy of war prosperity."

Mr. Whipp further said: "I think we should make it clear to the public of the United States that although the machine tool re-equipment of the plants and factories of America has an important bearing upon national defense, the machine tool builders of this country are, nevertheless, absolutely opposed to war and will cooperate to the fullest extent in helping in any possible way to keep this country out of war. I urge the passing of a resolution at this meeting proclaiming our united opinion to this effect." Such a resolution was passed by the Association later in the meeting.

Another inspiring address was made by W. T. Holliday, president of the Standard Oil Co. of Ohio, on the subject "Industry and the War." In this address, also, the abhorrence of war on the part of the American people was emphasized, and the desire of the great majority of people in this coun-

Frederick V. Geier, of the Cincinnati Milling Machine Co., Elected First Vice-president

Clifford S. Stilwell, of the Warner & Swasey Co., Elected Second Vice-president

W. E. Whipp, of the Monarch Machine Tool Co., Formerly President and Now Treasurer

try for the opportunity of pursuing the aims of civilization in freedom and peace was strongly brought out.

W. P. Kirk, sales manager, Pratt & Whitney Division, Niles-Bement-Pond Co., spoke on the subject "The Sales Department Can Help." A good salesman, according to Mr. Kirk, must today be a combination of engineer, diplomat, prophet, serviceman, and collector of important information on the detail requirements of the customer's work. Colonel E. E. MacMorland of the Procurement Planning Division, U. S. Army, Washington, D. C., spoke on "The Machine Tool Industry and the National Welfare."

George A. Bryant, Jr., executive vice-president of the Austin Co., described European conditions as he personally observed them as late as September. Both in England and in Germany, he found a serious shortage of skilled labor, as well as of the manufacturing equipment required in case of a prolonged conflict.

The new officers elected by the Association are: President, J. E. Lovely, vice-president and chief engineer of the Jones & Lamson Machine Co., Springfield, Vt.; first vice-president, Frederick V. Geier, president Cincinnati Milling Machine Co., Cincinnati, Ohio; second vice-president, Clifford S. Stilwell, executive vice-president Warner & Swasey Co., Cleveland, Ohio. The retiring president, Wendell E. Whipp, was elected treasurer of the Association. H. B. Kraut, president Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.; E. C. Bullard, vice-president and general manager of the Bullard Co., Bridgeport, Conn.; and Clifford S. Stilwell, who, as mentioned above, was also elected second vice-president, are the newly elected directors. Tell Berna was re-elected general manager, and Mrs. Frida F. Selbert, secretary.

Machine Tool Dealers Discuss Current Sales Problems

THE Associated Machine Tool Dealers of America held their annual convention in Cleveland, Ohio, October 5. The principal speakers at the meeting were the Association's retiring president, A. G. Bryant, president of the Bryant Machinery & Engineering Co., Chicago, Ill., and J. R. Weaver, director of equipment, inspection, purchases, and tests of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Mr. Bryant pointed out that the war, "far from benefiting the machine tool industry, has come at a time when it seriously interferes with the job of handling the present industrial market for machinery. Since the summer of 1938, the curve of machine tool business has been steadily rising as a result of the improved outlook in the automotive, farm equipment, and other industries.

"The machine tool industry, in protecting itself and in rendering a service to American business, must limit the amount of export sales that it accepts. It must be prepared to handle our own Government's requirements for machinery for navy yards and arsenals, and to meet with a reasonable delivery service the needs of its regular customers in our own domestic metal-working industries."

Mr. Weaver called attention to a great many subjects of interest equally to the machine tool seller and buyer. He also referred to the fact that any machine tools built for war and ammunition purposes will, when peace returns, be turned to peaceful uses, at that time creating a serious competition with the industry's product. He urged American machine tool builders to see that the equipment demand in this country is not sacrificed to the present temporary foreign demand.

John Sauer, Jr., of the Peninsular Machinery Co., Detroit, Mich., was elected president of the Association; F. B. Scott, Jr., of the Syracuse Supply Co., Syracuse, N. Y., was elected vice-president; and George F. Turner, of the Strong, Carlisle & Hammond Co., Detroit, Mich., was elected secretary-treasurer.

* * *

New Index of Machine Tool Business to be Issued

The National Machine Tool Builders' Association, Cleveland, Ohio, announces that recent conditions in the machine tool industry have made it difficult to determine firm orders, in making up the industry's index of new business. On that account, the Association is now engaged in constructing a revised index, in order to more nearly reflect the activity within the industry. The new data is expected to be available within a month or two.

* * *

Allis-Chalmers Honors Fifty-Year Men

The Allis-Chalmers Mfg. Co., Milwaukee, Wis., recently gave a dinner in honor of thirty-eight of its employes who had completed fifty years of service with the company. Each man was presented with a gold watch and with a booklet entitled "We've Gone Places Together." The booklet contains a picture of each of the men, as well as a tribute to their contribution to the success of the organization.

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 207 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the November Number of MACHINERY

Texrope Drives and "Lo-Maintenance" Motors

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Bulletin B-6029, describing the construction of Texrope V-belt drives and the savings effected by their use in a wide range of industries. Recommendations on the selection and specification of these drives are included. The catalogue also contains a section on "Lo-Maintenance" motors, covering mechanical features, applications of the various types, and prices. The Allis-Chalmers Mfg. Co. calls attention to the fact that its house organ "Texrope Topics," which contains accounts of new industrial developments and trends in the power transmission field, has been changed in size and make-up. In its new form, it has been enlarged to the size of current picture magazines, which permits the use of large striking illustrations. The house organ will be distributed quarterly. 1

Electrical Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Circular 2634, entitled "How to Select Protective Devices for Low-Voltage Power Circuits; 821G, on pressure and vacuum switches; 2230A, on rotating-cam switches; 3043, on oilproof, general-purpose, explosion-proof limit switches; 3281, on field switches. Bulletins 98B, 1276D, 1698A, and 1807B, descriptive of single-phase, repulsion motors; split-phase motors; wound-rotor induction motors; and squirrel-cage induction motors, respectively. 2

J-Metal Cutting Tools

HAYNES STELLITE CO., Kokomo, Ind. Revised edition of the booklet "Haynes Stellite J-Metal Cutting Tools," giving recommended procedures for the use of these tools which should be helpful to the machinist, engineer, tool supervisor and production man in obtaining maximum results. New material included covers tool-holders and adapters that effect savings in tool costs, and the new Haynes Stellite wear strips for driving and pilot bars. 3

Arc-Welding Equipment

LINCOLN ELECTRIC CO., 12818 Coit Road, Cleveland, Ohio. Bulletin entitled "101 Welding Ideas for Low-Cost Maintenance," illustrating and describing a wide variety of money-saving repair, fabrication, and structural applications of arc welding.

Welding specification bulletin No. 327A, descriptive of the Lincoln Shield-Arc Diesel-engine driven welder, designed for use in locations where electric power is not available or not economical to use. 4

Contour Metal-Shaping Machines

CONTINENTAL MACHINES, INC., 1301 Washington Ave., S., Minneapolis, Minn., is distributing special Job Sheet brochures which give detailed information about the Doall contour metal-shaping machine and the increased production, together with decreased costs, possible through its use. Separate manuals have been issued for the ship-building industry, and the plastics, silverware, and automotive fields. 5

Slide-Rule for Finding Bearing Sizes

JOHNSON BRONZE CO., 520 S. Mill St., New Castle, Pa., is distributing a convenient slide-rule which enables engineers and designers to readily find the size of over 800 standard stock bronze bearings. Those desiring one of these time-saving devices should make their request on a business letterhead. The data given for each different size bearing covers inside diameter, outside diameter, length, and part number. 6

Trucks and Pulleys

AMERICAN PULLEY CO., 4200 Wissahickon Ave., Philadelphia, Pa. Catalogue and price list T39, covering American pressed-steel trucks and industrial truck wheels. Bulletin MB38A, descriptive of the American tension-control motor base. Catalogue P-39, containing data on flat belt drives and American steel split pulleys. Circular giving prices of American Sprucolite motor pulleys. 7

Grinding Wheels

NORTON CO., Worcester, Mass. Catalogue 1052-1P, covering the Norton line of grinding wheels for tool-room grinding and for cylindrical, surface, and centerless grinding, as well as cutting off and a variety of other uses. Recommended wheel speeds, data on standard shapes, and list prices are included. 8

Electric Fuses

LITTELFUSE, INC., 4757 Ravenswood Ave., Chicago, Ill. Catalogue 8, covering the complete line of fuses made by this company, including aircraft fuses, high-voltage fuses, and a new line of "Slo Blo" fuses designed to carry overloads for a reasonable time, but to "blow" before the danger point is reached. 9

Optical Pyrometer

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia, Pa. Catalogue N-33D, illustrating and describing an entirely new temperature measuring instrument — the L&N potentiometer optical pyrometer, which measures industrial temperatures with laboratory precision. 10

Ball Bearings

MARLIN-ROCKWELL CORPORATION, Jamestown, N. Y. Bulletin 27, in a series on "Ball Bearing Practices for the Shop Man," dealing with S A E and A.B.E.C. standard lock-nuts for ball bearings. 11

Inclinable Presses

NIAGARA MACHINE & TOOL WORKS, 637 Northland Ave., Buffalo, N. Y. Bulletin 58-H, covering the complete

line of Niagara open-back inclinable presses, equipped with the Niagara fourteen-point engagement sleeve clutch and built-in single-stroke mechanism. 12

Gear-Hobbing Machines

MICHIGAN TOOL CO., 7171 E. McNichols Road, Detroit, Mich. Booklet entitled "Hobbing," containing a complete discussion of the hobbing of gears, splines, etc., including formulas and charts of value in the shop, as well as in the engineering department. 13

Vertical Hobbing Machines

BARBER-COLMAN CO., Rockford, Ill. Bulletin F1645, illustrating and describing the new Barber-Colman Type V vertical hobbing machine, designed for mass production combined with high accuracy and fine finish. 14

Bearing Lubrication

U. S. ELECTRICAL MOTORS, INC., 200 E. Slauson Ave., Los Angeles, Calif. Circular entitled "U. S. Lubriflush," descriptive of a new method of bearing lubrication by means of which old grease is automatically forced out as new grease is injected. 15

Gear-Finishing Machines

MICHIGAN TOOL CO., 7171 E. McNichols Road, Detroit, Mich. Booklet discussing the various methods of finishing gears, including rotary and rack shaving finishing methods, as well as the latest development known as "curve shaving." 16

Electric Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Leaflet F-8491, descriptive of heavy-duty motors of 1/8 to 1/2 H.P. for small machine tools, die grinders, blowers, air compressors, etc. 17

Industrial Cleaning Equipment

IDEAL COMMUTATOR DRESSER CO., 1011 Park Ave., Sycamore, Ill. Circular descriptive of three-way, hand, portable type vacuum cleaners with new safety features, for industrial use. 18

Rotary Air Grinder

INDEPENDENT PNEUMATIC TOOL CO., 600 W. Jackson Blvd., Chicago, Ill. Circular P20, containing complete data and specifications of a new Thor 5 1/2-inch, 17-ounce rotary air grinder known as "Bantam." 19

Heat-Treating Containers

AMERICAN MANGANESE STEEL DIVISION OF THE AMERICAN BRAKE SHOE & FOUNDRY CO., 389 E. 14th St., Chicago Heights, Ill. Bulletin 99, describing the use of Amsco alloy in heat-treating containers. 20

Face Shields

BOYER-CAMPBELL CO., 6540 Antoine St., Detroit, Mich. Circular illustrating fifteen different types of face shields for protecting welding operators and for other industrial applications. 21

Tapping Machines

R. G. HASKINS CO., 617 S. California Ave., Chicago, Ill. Catalogue illustrating and describing the Haskins Type C high-speed tapping machines with built-in air control. 22

Portable Electric Hammers

VAN DORN ELECTRIC TOOL CO., 735 Joppa Road, Towson, Md. Handbook of portable electric hammers, covering construction, uses, maintenance, and operation. 23

Forging Machines

ACME MACHINERY CO., 4535 St. Clair Ave., Cleveland, Ohio. Catalogue illustrating and describing Acme forging machines, as well as typical dies and forgings produced. 24

Cleaning Compound

QUIGLEY CO., INC., 56 W. 45th St., New York City. Circular AN-129, on Annite cleaning compounds, made in four different types to suit various industrial cleaning purposes. 25

Carbide Tools

SUPER TOOL CO., 21650 Hoover Road, Detroit, Mich. Folder entitled "Carbide Tool Salvage," explaining a service for salvaging broken or obsolete carbide-tipped tools. 26

To Obtain Copies of New Trade Literature

listed on pages 206-207 (without charge or obligation) mark with X in the squares below, the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

Name ..... *Position or Title* .....

[This service is for those in charge of shop or engineering work.]

Firm .....

Business Address .....

City ..... *State* .....

New Book on Patents

PATENT FUNDAMENTALS. By Adelbert Schapp. 176 pages, 5 1/2 by 8 1/2 inches. Published by THE INDUSTRIAL PRESS, 148 Lafayette St., New York City. Price, $2.

This is a textbook for inventors, executives, and students which explains in non-technical language and demonstrates by practical examples the underlying principles of true invention, procedure in obtaining patent protection, drafting effective claims, making assignments, issuing licenses, and, in brief, how to protect both invention and inventor.

Many inventors have failed because they did not receive the patent protection warranted by their inventions. The best and most approved ways of defining and protecting an invention are illustrated by numerous practical examples and thorough discussions of many important court decisions. By studying this material, the inventor or student should become a fair judge of patent claims. Engineers of all kinds, chemists, and executives interested in inventions will find the information required for cooperating intelligently with patent attorneys in preparing and prosecuting patent applications. The chemist's problem is discussed, and there is an analysis of decisions relating to chemical patents.

Many executives are called upon to make important decisions relating to patent matters. Questions arise concerning the interpretation of the scope of a patent, the validity, and possible infringement. Attorneys-at-law, who are often consulted in a preliminary way in patent matters, will find much desired information on questions of patentability, the preparation of assignments and license contracts, and the most important issues in infringement suits.

This treatise includes information on trademarks and copyrights, design patents, prints and labels, and illustrates the different conditions under which these protective measures become available. It is written in textbook style, and is adapted for use in educational institutions having courses dealing with the fundamentals of patent law.

Individual Shows Held by Machine Tool Builders

The month of October witnessed several machine tool shows held by individual concerns for the purpose of introducing and demonstrating the latest types of machines which they had planned to exhibit at the cancelled Cleveland Show. The first show was held October 9 to 14, inclusive, by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. The machines demonstrated included the heavy-duty 50 series horizontal boring, drilling, and milling machines which are built in floor, table, and planer types; the 30 series machine equipped with a built-in power revolving table; and a new continuous-feed facing head. All of these developments were described in October MACHINERY.

In the Detroit area, a show was staged by the National Broach & Machine Co. during the week of October 16 to 21. The machines demonstrated there included the RotoShaver and the RotoMill described in October MACHINERY, as well as a lead comparator, gear lapping machine, gear speeder, gear shaving machine, and gear testing machine. The exhibit was held in the new addition to the company's plant, which is rapidly nearing completion. This addition of 17,000 square feet is the fourth in four years.

Also, during the week of October 16 to 21, a community show was held in Springfield and Windsor, Vt., sponsored jointly by the Jones & Lamson Machine Co., the Fellows Gear Shaper Co., the Bryant Chucking Grinder Co., and the Cone Automatic Machine Co. These concerns exhibited, in operation, their newest developments, described in October MACHINERY and in the New Shop Equipment Section of this number of MACHINERY, as well as other machines recently described.

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 209-232 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment mark with X in the squares below, the identifying number found at the end of each description on pages 209-232—or write directly to the manufacturer, mentioning machine as described in November MACHINERY.

51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77
78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Machines Introduced at Springfield-Windsor Show by the Fellows Gear Shaper Co.

Five machines of entirely new design for use in the machining, hardening, and inspection of gears were included in the exhibit of the Fellows Gear Shaper Co. at the community machine tool show held in Springfield and Windsor, Vt., from October 16 to 20. One of these new developments is the straight-line gear generator shown in Fig. 1, which employs a rack type cutter, as illustrated in Fig. 2, for cutting small external spur and helical gears on a high-production basis for use in recording instruments, meters, motion-picture cameras and projectors, clocks, and similar products. The machine is arranged for automatically loading and unloading the work.

The rack type cutter is 6 3/8 inches long or approximately the same length as the pitch circumference of a 2-inch gear, which is the maximum capacity of the machine. For cutting smaller gears and pinions, the rack cutter is made with groups of teeth that are separated by gaps, as seen in Fig. 2. The number of teeth in each group equals the number of teeth on the work to be cut. Thus, in cutting small gears or pinions, the first group of teeth at one end of the cutter is used until those teeth become dull, then the next group, and so on until all have become dull.

The rack type cutter is carried in a clapper-box holder which is mounted on a swivel-plate attached to a slide. This slide can be reciprocated as fast as 2000 strokes a minute.

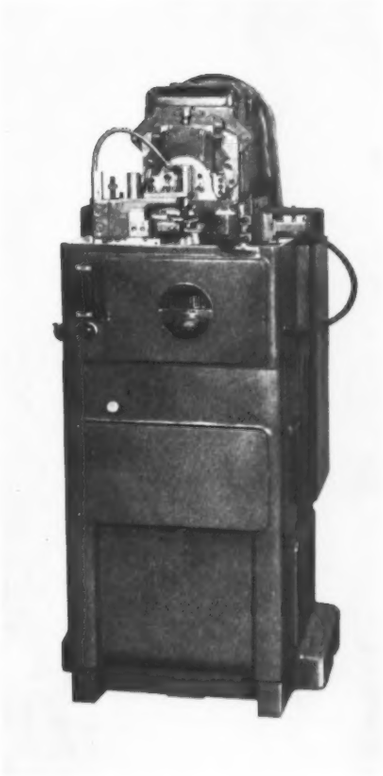


Fig. 1. Fellows Straight-line Gear Generator which Employs a Rack Type Cutter

The bed of the machine, which carries the rack-holder and slide, is traversed by a lead-screw, there being a compensating device which works in combination with change-

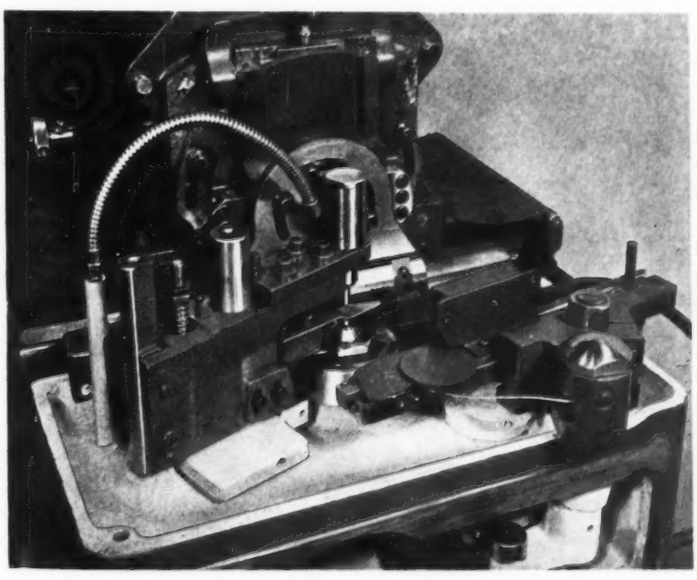


Fig. 2. The Rack Type Cutter and Automatic Magazine, Work-holding and Ejecting Mechanisms of the Machine Shown in Fig. 1

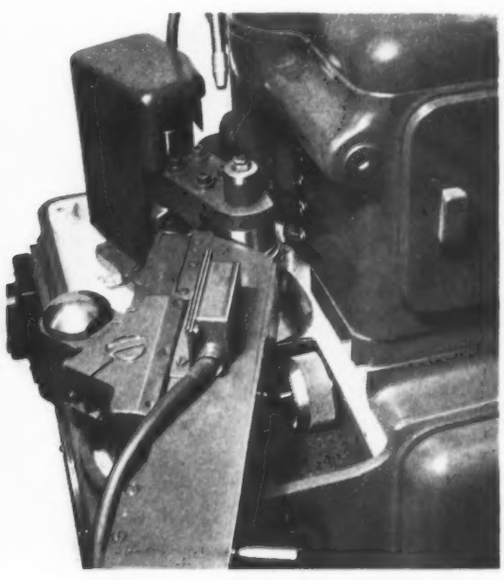


Fig. 3. Close-up View of the Fine-pitch Gear Generator which Employs a Disk Type Cutter

To obtain additional information on equipment described on this page, see lower part of page 208.

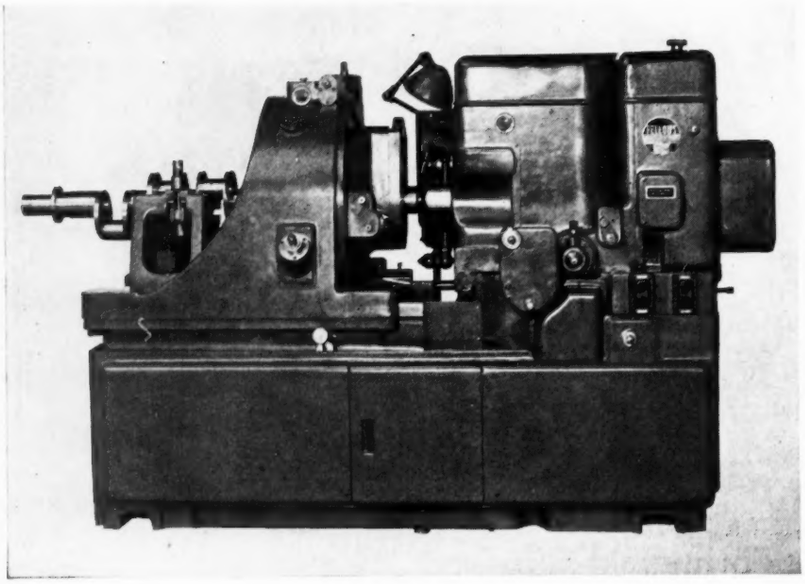


Fig. 4. Horizontal Type of Gear Shaper Developed for Cutting Gears or Clutches that are Integral with Long Shafts

gears to effect the required linear travel of the bed in order to keep the rack-cutter in the proper relation to the work. This device also affords a means for obtaining slight increments in the rate of travel of the rack-cutter without altering the change-gears.

When this machine is equipped with a magazine feed, the position of the rack-cutter relative to the work is controlled by dogs which operate a reversing mechanism that changes the direction of bed travel. These dogs can be set for short traverses of the bed at any point within the maximum length of travel. For instance, in cutting pinions having a small number of teeth with a cutter having several groups of teeth separated by gaps, the dogs would be set to use the first group of teeth at one end of the cutter, as already mentioned, and the bed would be traversed first in one direction and then in the other. A pinion would be finished upon the completion of each traverse.

When the first group of teeth on the rack-cutter become dull, the dogs are shifted to enable the application of the next group of teeth, and so on. The gaps in the rack-cutter permit loading and unloading of the work without stopping the operation of the machine or withdrawing the cutter from the work. This machine can also be arranged for hand loading, in which case a limit switch at the rear stops the machine upon the completion of each gear.

Another new gear shaper designed for cutting small fine-pitch gears up to 3 inches pitch diameter and 3/4 inch face width by employing a disk cutter has somewhat the same general appearance as the machine shown in Fig. 1. It also incorporates a number of interesting features, including the means employed for

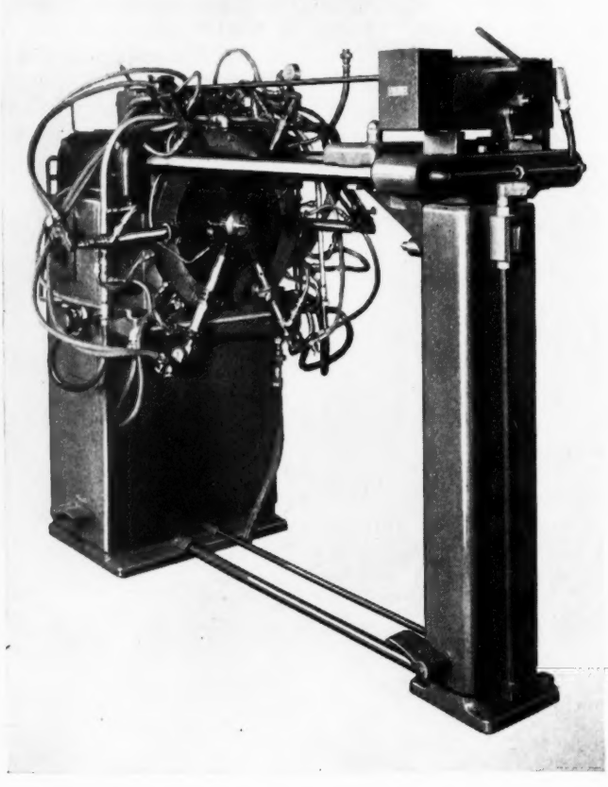


Fig. 5. Flame-hardening Machine Developed for Hardening Gears and a Large Variety of Other Parts

Fig. 6. Involute Measuring Machine Equipped with an Electric Gage and an Electrical Recording Device

To obtain additional information on equipment described on this page, see lower part of page 208.

automatically feeding, holding, clamping, driving, and ejecting the work. This machine operates at cutter reciprocating speeds as high as 2000 strokes per minute.

A close-up view of the magazine used on this machine for handling thin gear blanks is shown in Fig. 3. The blanks are stacked on an auxiliary holder, such as seen lying on the machine, and the entire assembly is fed through the magazine. The lower face of the holders is serrated to mesh with corresponding serrations on the locating and driving adapter on the work-spindle.

A work clamping mechanism operates in conjunction with the magazine and carries a ball-bearing centering and clamping support. The clamping member is elevated by a cam which is timed with a second cam that operates the magazine. When the work support is raised by one cam, the work ejector is also raised to remove the work from the adapter or work-spindle, as the case may be. After the work has been ejected from the cutting position, the magazine swings into place for loading another assembly of gear blanks, the support is lowered to clamp the work, the magazine withdraws, and the cutter is again fed to depth. This machine is also available without a magazine.

The Z model gear shaper illustrated in Fig. 4 constitutes a striking departure from the regular line of Fellows gear shapers in that it is of a horizontal type. This machine is particularly suited to cutting the teeth of gears or clutches that are integral with long shafts, such as airplane engine crankshafts. The work-spindle is mounted in a slide which is adjustable along the base for positioning the work relative to the cutter. The slide also carries a bracket equipped with a swinging shoe to provide additional support for the work. The work is held in an adapter in the work-spindle.

The cutter-spindle is of the "relieving" type, and is held in a slide that is adjustable along the base at right angles to the work-slide. Movement of the cutter-slide controls the diameter setting of the cutter in relation to the work. The cutter-spindle is controlled by a guide in a similar manner to that employed on the regular gear shapers. This machine is also provided with an electric push-button control and a mechanism that stops the machine each time that a gear or clutch is finished.

Another outstanding development of the concern is the flame-hardening machine illustrated in Fig. 5, by means of which the local hardening of gear teeth and a large variety of other parts made from oil-hardening steel can be accomplished. In operation, the gear to be hardened is rotated within oxy-acetylene torches mounted radially on the machine, so that the entire gear surface is brought to the desired temperature within a short time. The work is held on a stub arbor or between centers, depending on its shape, and is driven from the headstock spindle. The latter is driven through a Texrope drive which gives a speed range of about 125 to 800 R.P.M. Foot-treadles at both ends of the machine are used to operate an ejector for removing the work from the stub arbor, and a transfer device then immerses the work in a quenching medium.

In the illustration, the work is seen surrounded by six torches, each of which is provided with a number of nozzles. The torch equipment is carried on a saddle that is adjustable along two brass pipes for locating the torches in the desired relation with the work. There is ample room for the installation of a quenching tank. This machine has capacity for work up to 12 inches in diameter, of 2 inches face width, and with shaft lengths up to 36 inches.

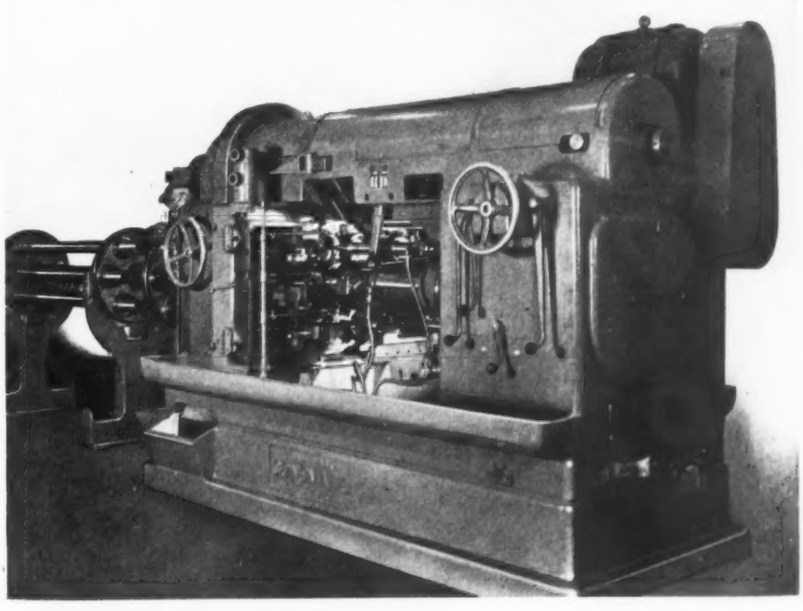
An addition has been made to the line of Fellows involute measuring machines by the development of the No. 12M Model shown in Fig. 6. This machine is similar in design to the No. 6M, but is larger and heavier in construction, accommodating gears up to 12 inches pitch diameter.

This machine has an electric gage which can be used as a limit gage when a number of gears are to be checked and permanent records are not required. It can also be provided, if desired, with an electrical recording device, as shown, for automatically charting the involute profile of gear teeth. The work-spindle is mounted in pre-loaded bearings.

The work-spindle sleeve is adjustable vertically for positioning the gear in relation to the involute pointer. It is possible to check individual gears on a cluster, for example, without removing the work from the machine. The pointer slide is set in the radial position by means of a size-block pivoted to the slide. A spring keeps this block raised to clear the locating stop on the main slide when "rolling the involute."—51

Conomatic with Hydraulic Action for Stock Feed and Attachments

One of the outstanding machines in the community machine tool show held last month in Springfield and Windsor, Vt., was a 3 1/2-inch Conomatic exhibited by the Cone Automatic Machine Co. This machine,



Conomatic of 3 1/2-inch Size, which is Provided with a Hydraulic Action for Operation of the Stock Feed and Unusual Attachments

To obtain additional information on equipment described on this page, see lower part of page 208.

which follows the general construction of other Conomatics, has the additional feature of hydraulic equipment for actuating the stock feed and unusual attachments.

The machine exhibited was equipped with a motor-driven chip conveyor. This unit can be readily removed for cleaning purposes, the stock-feed support being arranged with rollers to facilitate the removal. Fourteen tool stations are provided on the machine. It has a weight of approximately 20 tons. 52

Bryant Internal Grinder with Under-Head Slide-Bar

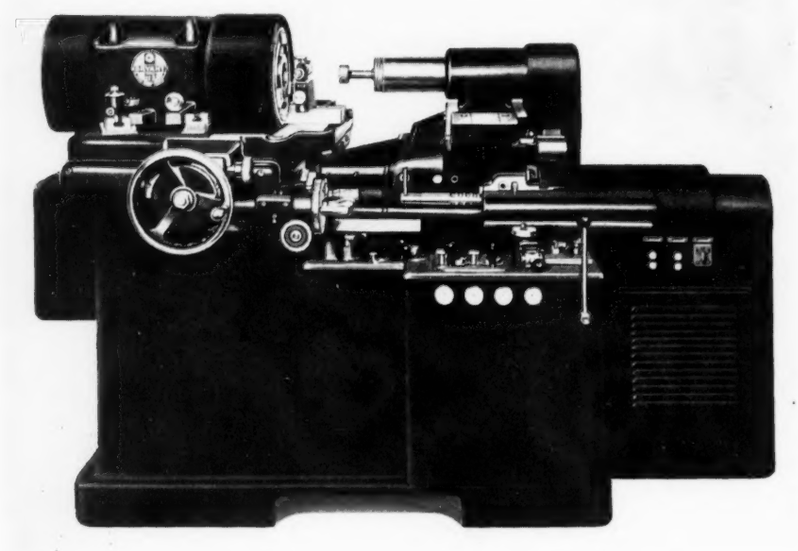
An under-head slide-bar for the grinding wheel instead of the overhead slide-bar that has characterized previous grinders built by the Bryant Chucking Grinder Co., is a distinctive feature of a No. 112 machine shown for the first time at the machine tool show held in Springfield and Windsor, Vt., from October 16 to 20, inclusive. This machine is a general-purpose hole grinder provided with fixtures that permit quick setups, convenient operation, high production, quality finishes, and a high degree of accuracy.

The advantages of the Bryant slide control have been retained by mounting the wheel-spindle above a rugged cylindrical bar that is carried in widely separated cylindrical bearings, and by supporting the rear of the slide on a hardened guide plate. This mounting provides a stable three-point support for the wheel-slide that will maintain alignment through long service. The three supported points are pressure-lubricated.

The under-slung slide-bar also serves as a cylinder for the hydraulic longitudinal wheel traverse. In addition to the conventional control lever for the automatic operation of the slide, there is a valve that provides a still more accurate control of this movement, a feature that is particularly advantageous in face-grinding operations. A micrometer stop is used in conjunction with this valve in face grinding.

The wheel-slide is provided with a flat top surface that permits positioning of the wheel-spindle to suit the operation to be performed. An auxiliary facing spindle can be furnished, in addition to the standard hole-grinding spindle. The work-spindle is mounted in super-precision ball bearings, and is driven by a variable-speed reversible hydraulic motor that provides a wide selection of work speeds in either direction.

The work-head can be swiveled for grinding tapers up to an included angle of 90 degrees. The cross-feed screw which controls the movement of the table on which the work-head is mounted can be operated at a fast rate or by a micrometer feed. Attachments can be furnished to handle a wide variety of work. The total chuck swing of this machine, without a guard and with the work-head on center or adjusted to a 45-degree position, is 12 inches; the maximum traverse stroke of the grinding wheel is 12 inches; and the grinding stroke of the wheel is 10 inches. The 3-H.P. hydraulic motor used for driving the work can be operated at speeds of approximately 375 to 1350 R.P.M., giving work-spindle speeds of from 80 to 1000 R.P.M. 53



Bryant Internal Grinder Built with an Under-head Slide-bar Instead of the Overhead Bar that has Previously Characterized Bryant Grinders

Jones & Lamson Comparator for Inspecting Spherical Surfaces

The Jones & Lamson Machine Co., Springfield, Vt., has brought out a specially designed comparator for inspecting spherical surfaces. The determination of the size and nature of flaws on highly finished surfaces, such as the surfaces of balls used in precision ball bearings, has previously necessitated the use of expensive instruments by experienced operators. The new comparator makes the inspection of spherical surfaces on work of this kind a simple, yet exact procedure, which saves time and does not require highly skilled operators.

An enlarged image of the surface being inspected is projected on a concave hemispherical screen 15 inches in diameter. Magnification depends on the size of the work, a 1/4-inch ball, for example being magnified sixty times. The instrument can be used to inspect spheres up to 1 1/2 inches in diameter..... 54

Prest-O-Weld Welding and Cutting Equipment of Improved Design

A number of improvements are featured in a line of Presto-O-Weld welding and cutting apparatus recently introduced on the market by The Linde Air Products Co., 30 E. 42nd St., New York City. This new equipment consists of a welding blowpipe, a cutting blowpipe and a cutting attachment, all of which retain the detachable valve body construction which permits of quick changing from welding to cutting and from cutting to welding.

Among the principal features of the W-108 welding blowpipe are individual mixers in each head for making correct flame adjustments easy and for giving a definite resistance to flash-back. Both the oxy-

To obtain additional information on equipment described on this page, see lower part of page 208.

gen and acetylene for this "balanced-pressure" blowpipe can be set at about the same pressure in pounds per square inch as the number of the head.

The welding heads provide a long, slender flame with a well formed inner cone that permits thorough heating of even the bottom of vees and provides a good control of the welding puddle. Special heads that confine the flame to a small area are available for such work as automobile fenders.

In the C-108 cutting blowpipe and the CW-108 cutting attachment, a low pre-heat oxygen pressure permits a large flame for cutting very dirty or heavily scaled material. Like the welding blowpipe, these units provide a definite flash-back resistance and are well balanced for ease of handling. All the apparatus described is available separately or in combination outfits. 55

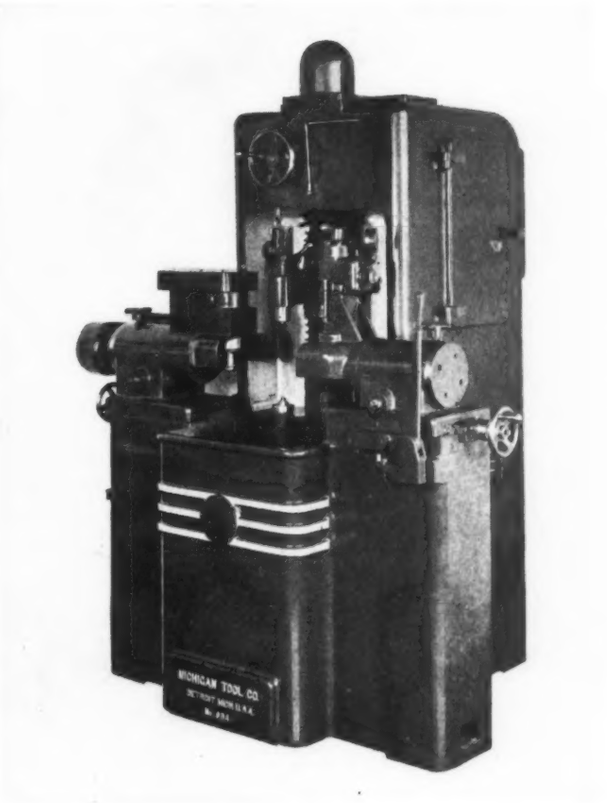


Fig. 1. Michigan Two-lap Vertical Gear-lapping Machine for Moderate and Small Size Gears

Michigan Two-Lap Gear-Finishing Machines

Gear-finishing machines of a two-lap type, just brought out by the Michigan Tool Co., 7171 E. McNichols Road, Detroit, Mich., in both vertical and horizontal models, employ the crossed-axis method of gear finishers previously introduced by this company. The new machines are automatic in operation and are provided with electrical controls which permit adjustment of the lapping cycle to meet virtually every possible variation desired. They are designed for the high-production lapping of gears ranging from 1/2 inch to 8 inches in diameter, and are not restricted as to the pitch of the gears. The machines are also available for finishing gears from 1 to 12 inches in diameter.

The machines operate at a relatively low surface speed, but with a high speed of reciprocation of the laps across the gear faces. A single adjustment makes it possible to vary this speed from 90 to 300 reciprocations per minute. A change-gear box provides speeds ranging from 52 to 283 R.P.M. of the first lap-spindle. The length of the reciprocating stroke can be adjusted to suit requirements.

Two timing devices are provided to permit individual adjustment of the lapping time on either side of the teeth, the range being from two seconds to twenty minutes in either direction. When the machine is in operation, two laps are mounted on the spindles, while the gear to be lapped is mounted on live centers between the laps. The lap-spindle heads are adjustable to provide the correct crossed-axis setting.

Individual motor drives are used for the lap-spindles and for reciprocating the work. A motor drives one of the lap-spindles, the lap, in turn, driving the work and the work driving the second lap, the spindle of which is equipped with a hydraulic brake. A second motor oscillates the work-carrying head in line with the axis of the gear.

After the timing devices are set, starting of the machine causes the laps to revolve in one direction for the first preselected period, and then automatically reverse and lap the gear in the opposite direction for a second preselected period. The machine then stops automatically. One lap-spindle is next retracted by means of a hand-lever to permit the lapped gear to be removed, after which another gear is loaded in mesh with the second lap and the retracted lap is again

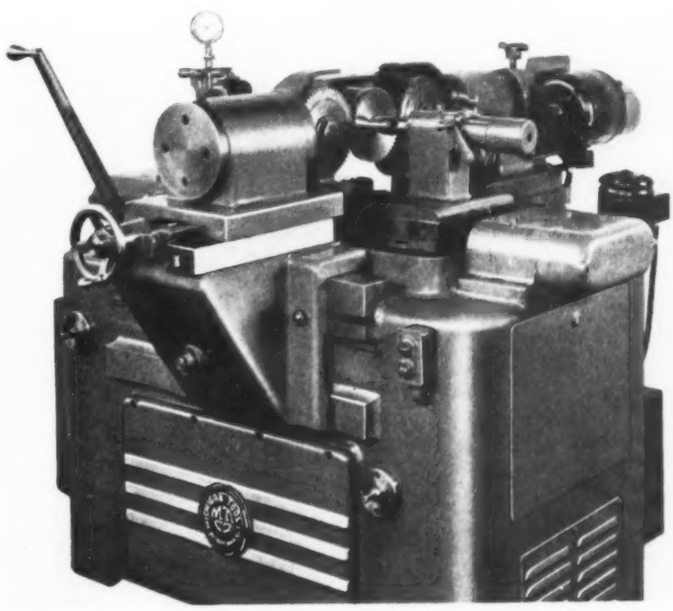


Fig. 2. Horizontal Model of the Michigan Two-lap Crossed-axis Gear-lapping Machines which Oscillate the Work at Speeds up to 300 Strokes per Minute

To obtain additional information on equipment described on this page, see lower part of page 208.

brought into the lapping position by means of the control handle. The arrangement insures that the laps and gears will always mesh properly, thus eliminating any damage to the laps.

Particular attention has been given in the design of these machines to protecting the bearings and other parts, against dust and lapping grit. The work-carrying spindles are provided with full-length accordion type seals for this purpose, as may be seen from the illustrations.

The lap-spindle heads are provided with individual screw adjustments and graduated dials to facilitate set-ups. The movable spindle is equipped with adjustable stops to insure that the lap is always correctly positioned as to depth relative to the work. 56

Westinghouse Heat-Treated Gears for Industrial Use

A complete line of heat-treated gears for heavy-duty industrial applications is being placed on the market by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These gears are heat-treated by the Barnes process, and are especially designed to give long life and dependable service under adverse operating conditions, as in cranes, mine hoists, locomotives, and various types of milling and mining machinery. The heat-treatment gives the gears a hard wearing surface that tapers off on the inside to an extremely tough core, thus providing a high shock resistance, in addition to resistance to wear. 57

Norton Tool and Cutter Grinder with Anti-Friction Table

An anti-friction table is an interesting feature of a new No. 2 cutter and tool grinder designed by the Norton Co., Worcester, Mass. All the balls that support the table are carefully selected for size, and the machine is built with hardened steel ways. An adjustable braking device permits a "drag" to be imposed on the table, and also provides means for locking the table securely in some specific position. The "drag" is an important feature, as there are many operations for which a freely running table is undesirable.

The cartridge type ball-bearing wheel-spindle is driven by a 1-H.P. motor carried on the lower end of a heavy column. A single V-belt from the motor in the column drives the spindle. Graduations on the wheel-head permit the spindle to be set at any angle in a horizontal plane.

The distance from the front control handwheels to the work-center permits the operator to work comfortably from the front of the machine. The work-table never overhangs the front of the base, and consequently is firmly supported at all times. Supplementary handwheels at the rear permit operation from either side, as well as from the front, depending on the nature of the work and the operator's preference. Toe holes at the front and at each side of the base enable the operator to stand close to the machine.

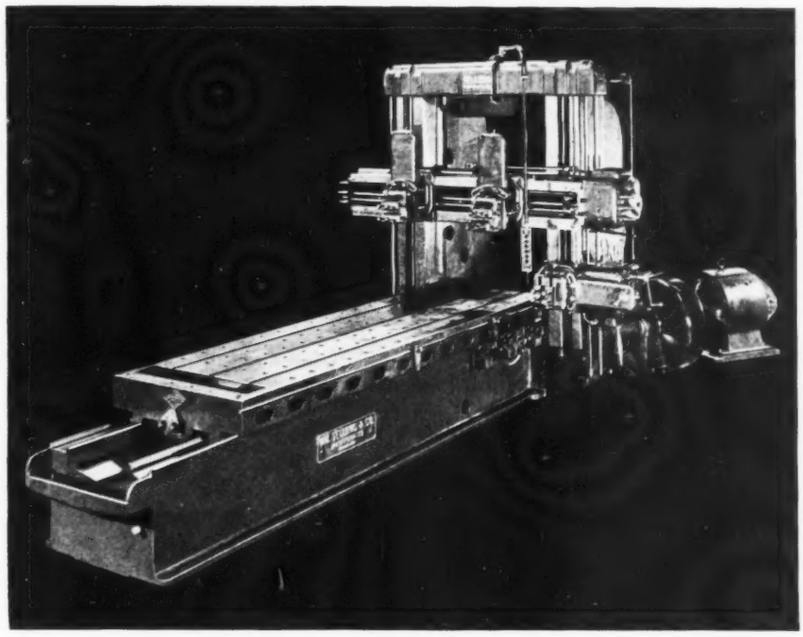
The machine is available either as a plain center grinder or as a universal machine, the only difference being that more equipment is supplied with the universal model. Both models are equipped with a universal work-head that takes milling cutters having the standard No. 50 taper, which has a taper of 3 1/2 inches per foot. Reducing collets for Nos. 12, 10, 9, and 7 B & S and No. 2 Morse tapers can also be supplied.

Both the universal work-head and the left-hand footstock are provided with clearance-angle setting dials. In addition to the plain equipment, the universal model includes attachments for internal, surface, cylindrical, and gear-cutter grinding. Other attachments are available for hobbing, forming, face-milling, and long reamer grinding. The machine weighs from 2200 to 2500 pounds, depending on the equipment, and requires a floor space of 4 feet 8 inches by 6 feet. 58

Fig. 1. Front View of Norton No. 2 Cutter and Tool Grinder

Fig. 2. Side View of Cutter and Tool Grinder Shown in Fig. 1

To obtain additional information on equipment described on this page, see lower part of page 208.



Completely Centralized Control is One of Many New Features on This Sellers Planer

Sellers "Power Flow" Planer with Centralized Control

A "Power Flow" planer has been developed by William Sellers & Co., Inc., Philadelphia, Pa., to provide a high degree of accuracy, quicker change-overs, easy control, and other advantages. Besides a spiral gear drive and the use of anti-friction bearings throughout, the important features include compound table ways, which eliminate climbing of the table caused by unequal expansion of the table and the bed; a tool apron designed with horizontal T-slots its full width to provide a greater variety of tool positions; a tool-holder abutment with an adjustable feature; a tool-slide that has two-thirds of its travel below the cross-rail, and that has a full-length bearing surface at every point of its travel; centralized micromatic controls; and an extended back cross-rail that has a full section extending from upright to upright. Pressure feed lubrication is supplied by an independently powered pump.

The operator can run the entire machine without moving from his normal working position at the end of the cross-rail. Automatic operation in either direction, inching for setting work, starting of the feed, etc., can all be controlled from a pendent push-button station. Power feed and traverse controls for the rail-heads are provided on the feed-box at the end of the cross-rail.

Rail elevation is accomplished by pulling down a lever positioned at the right-hand side of the machine. Turning the same lever one way or the other controls the direction of movement. The standard rail-heads have sixty-four feeds ranging from 1/64 to 1 inch. The slides also have sixty-four feeds ranging from 1/128 to 1/2 inch. The side-heads have sixty-four vertical feeds ranging from 1/64 to 1 inch.

With a 4-to-1 constant voltage motor, cutting speeds ranging from 25 to 75 feet per minute and return speeds of 50 to 100 feet per minute are available. A variable-voltage motor provides cutting and return speeds with a 30 to 1 range. 59

Weld Timer and Contactor for Manually Operated Spot-Welders

A low-cost combination weld timer and contactor which is designed to provide weld timing control for practically any manually operated 1 to 15 K.V.A. spot-welder, and is capable of the accuracy required to permit the welding of stainless steel, aluminum, or brass has been brought out by the Weltronic Corporation, 2832 E. Grand Blvd., Detroit, Mich. This unit is available for operation on 110, 220, or 440 voltages, and 25-, 50-, or 60-cycle frequencies.

The new time-contactor unit is adjustable in one-cycle steps over the standard 1- to 60-cycle timing range. The unit consists of a single electronic tube, a relay, and a contactor, together with a time selector switch mounted in a compact spring-hinged cover case. 60

Redin Floor Type Sensitive Drilling Machine

The Crescent Mfg. Co., 1104 Tenth St., Rockford, Ill., has brought out a floor type Redin No. 0 sensitive drilling machine with a capacity for drilling holes up to 5/16 inch in diameter in cast iron and mild steel. This machine is designed for both high-speed production and tool-room work. The spindle is driven by the "rolling wedge" four-spindle transmission, which is claimed to be as powerful as a gear drive, yet smoother running than a belt drive.

With the rolling wedge drive, the pressure is automatically adjusted to the resistance offered by the work, and wear is practically eliminated, as power is transmitted by rolling contact. The machine is equipped with New Departure grease-sealed ball bearings. The spindle travel is 3 3/8 inches, and the distance from the spindle to the column is 6 1/2 inches. The minimum distance obtainable between the table and the

Drilling Machine Designed for Both High-production and Tool-room Work

To obtain additional information on equipment described on this page, see lower part of page 208.

chuck is 2 inches, and the maximum distance is 20 inches. The 1/2-H.P. motor operates at a speed of 1725 R.P.M. The spindle speeds are 900, 1800, 3300, and 5000 R.P.M. The over-all height of the machine is 68 inches. 61

Van Norman Light Milling Machine

The Van Norman Machine Tool Co., Springfield, Mass., has just brought out another milling machine, which is the fourth to be placed on the market by this company within the last two months. This new machine, designated the No. 2-L, is a light model which is available in plain and universal types.

The modern design of this machine has been worked out to embody exceptional rigidity. Front and rear controls, six-way rapid traverse, a wide range of speeds controlled by a single-lever selector, and a high degree of precision, sensitivity, accuracy, and compactness are features of the machine. It has eighteen spindle speeds ranging from 30 to 1450 R.P.M. and twelve table feeds ranging from 1/2 inch to 36 inches per minute. The table is 45 by 10 inches. 62

Westinghouse Electric Furnace for Hardening Tool Steels

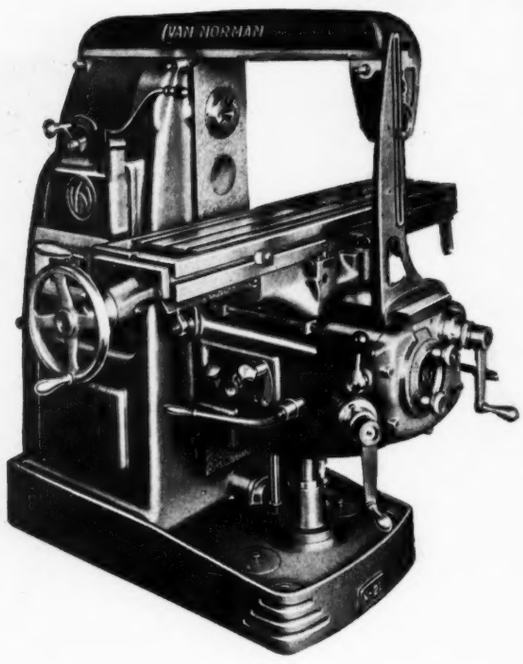
An electric furnace employing Ammogas in the hardening of tool steels has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Damage to tool steels by oxidation, decarburization, distortion, or cracking during hardening is eliminated through its use. The Ammogas atmosphere is so inactive with carbon that not even a soft skin forms on 1.5 per cent steel stock soaked for an hour at a temperature of 1850 degrees F. Its composition needs no adjustment to suit the requirements of the steel being hardened, and the strongly reducing character of the atmosphere is an aid in hardening stainless steel without tarnishing.

The furnace is tilted at an angle of 20 degrees, with the entrance at the low end. As Ammogas is lighter than air, this arrangement prevents contamination of the pure gas atmosphere in the furnace, even with the entrance open. Special radiation shields serve to keep the heat uniform. Preheating of the work is unnecessary, and cooling is accomplished faster in the gas atmosphere than in air. The heat-treatment requires from one to three hours, according to the type of work. The tool or die hardened in this furnace has a bright, clean surface. 63

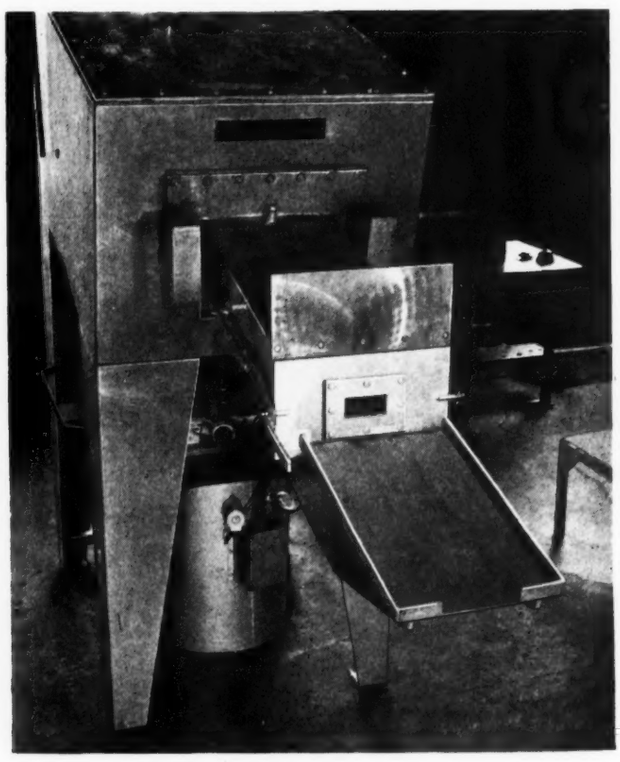
Wallace Hydraulic Ram Type Pipe-Bending Machine

The Wallace Supplies Mfg. Co., 1310-12 Diversey Parkway, Chicago, Ill., has recently developed a hydraulic ram type bending machine. This machine is available in five sizes having a range of capacities for extra heavy pipe from 6 up to 12 inches and for tubing in sizes up to 15 inches outside diameter with 3/4-inch walls.

These machines, known as the No. 700 Series, are made up entirely of rolled steel plates and sections. They are designed to permit the tool equipment to be changed quickly. The center die, for example, can be changed by removing and replacing only one stud. In changing the end dies, it is only necessary to remove four bolts and loosen two nuts. To adapt the machine for handling a smaller size pipe, it is only necessary to move two large vertical pins to correspond with the pipe size

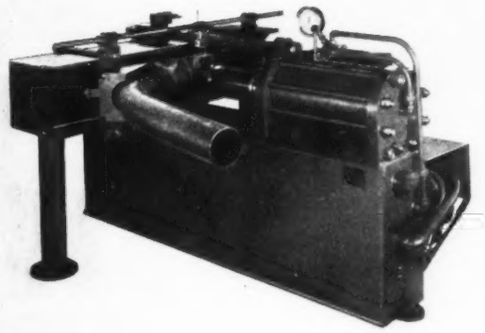


Van Norman Light Milling Machine Available in Plain and Universal Types

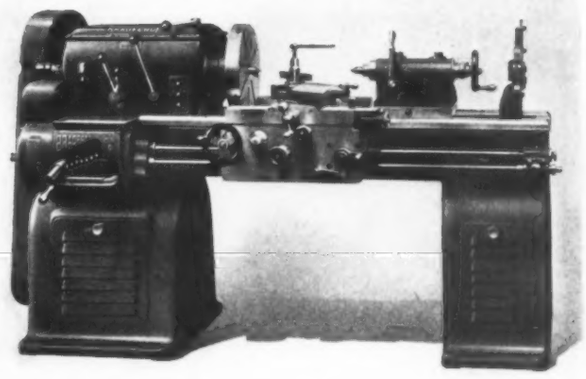


Westinghouse Electric Furnace that Utilizes Ammogas for Hardening Tool Steels

To obtain additional information on equipment described on this page, see lower part of page 208.



Pipe-bending Machine Built in Five Sizes by the Wallace Supplies Mfg. Co.



Improved Lathe of New Series Brought out by the Bradford Machine Tool Co.

marked on the machine, and tighten the collars securely on the horizontal tie-rods.

Positive control of the bending die which is attached to the ram is secured by a single, hand-operated hydraulic control valve, which is automatically returned to the neutral position when the machine is not in use. 64

Bliss Presses of Enclosed Design

A line of presses of enclosed design has recently been brought out by the E. W. Bliss Co., 53rd St. and 2nd Ave., Brooklyn, N. Y., for the automotive and stamping fields. The press shown in the illustration is of the four-eccentric type, the slide being actuated by a connection at each corner, which is driven by an eccentric. The eccentric shafts run from front to back in main bearings which are mounted in the heavy crown ribs, so that the thrust loads are distributed throughout the crown.

The clutch is of an improved design and is operated through an electric push-button control. The flywheel is mounted on Timken roller bearings, and can be stopped by a brake after the power has been shut off. Barrel type connections on the slide permit an adjustment of 6 inches through an electric motor. The counterbalancing cylinders are mounted within the uprights and bed to preserve the lines of the press.

This machine operates at fourteen strokes per minute and has a rated capacity of 750 tons. The die space between the bed and the slide, with the stroke down and the adjustment up, is 60 inches, while the stroke of the slide is 24 inches.

Presses of the construction described are now available in many different sizes, and in double-crank, double-eccentric, four-crank, and four-eccentric styles. 65

One of a New Line of Bliss Presses of Enclosed Design

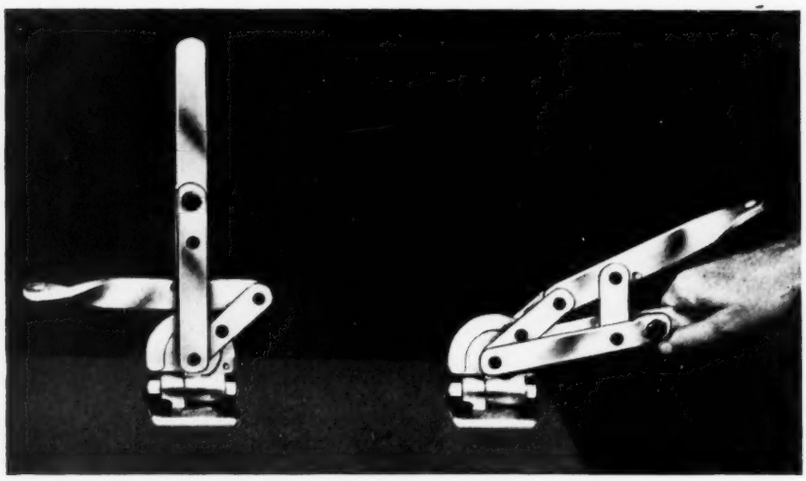
Bradford Lathes of Improved Design

The lathe here illustrated is one of a new series developed by the Bradford Machine Tool Co., 657-671 Evans St., Cincinnati, Ohio. The head of this machine is of heavy box type construction with a center bracing wall designed to assure rigidity under the heaviest cuts. Precision taper roller bearings are used throughout for all rotating shafts, the spindle being equipped with preloaded heavy-duty bearings of this type. Twelve selective speeds controlled by three conveniently positioned levers are obtained through sliding gears.

The drive from the constant-speed motor to the selective gear shaft is through multiple V-belts and a multi-disk clutch. The lever that controls this clutch also operates a multi-disk brake. With this arrangement the spindle can be stopped instantly and "jogged" without stopping the motor by simply manipulating one lever.

The reversible motor is mounted in the ventilated machine leg and is controlled by push-buttons. All moving parts in the head are lubricated by the splash system. A plunger pump driven from the spindle forces oil to all the roller bearings. The quick-change gear-box is arranged for selective feeds and thread cutting. The thread "index" gives a

To obtain additional information on equipment described on this page, see lower part of page 208.



Danly Kwik-Klamp Toggle Clamps for Wide Application to Dies, Jigs, and Fixtures

complete range of standard threads, and ordinary change-gears can be used between the lead-screw and spindle for cutting special threads. An automatic stop and a separate reverse in the apron are provided for the feeds. 66

Danly Kwik-Klamp Toggle Clamps

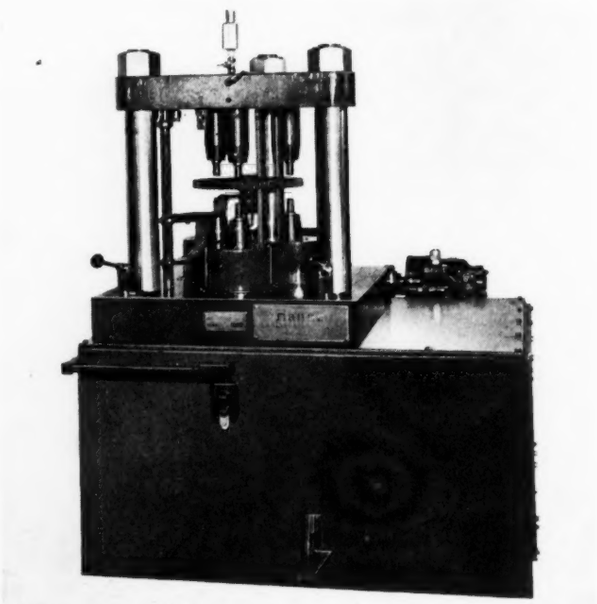
Toggle clamps designed for the quick and positive clamping of work in any position have been brought out by the Danly Machine Specialties, Inc., 2112 S. 52nd Ave., Chicago, Ill., for application to fixtures used in drilling, tapping, reaming, boring, welding, press, and assembly operations.

These clamps are of an improved design that has the advantages of simple installation and operating convenience, as well as providing a wide range of clamping and adjustment. All members revolve as a unit around a center pin in the semi-circular base. Any angle or compound angle can be obtained at the point of clamping with the clamps mounted directly on either flat or vertical faces of a die, jig, or fixture. This feature eliminates the need of machining angular pads on fixtures.

Another important feature is an adjustment of the operating handle to clear overhanging panels or for operating convenience. The clamping bar is adjustable from the horizontal upward to 50 degrees and downward to 90 degrees. 67

Hanna Electric-Hydraulic Riveter

A gear and hub assembly riveter of the construction illustrated is the latest addition to the line of electric-hydraulic riveting machines built by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. This machine is of the strain rod and platen type. It is equipped with three pairs of dies for simultaneously driving three rivets 120 degrees apart.



Electric-Hydraulic Riveter Built by the Hanna Engineering Works for Use in the Assembly of Gears and Hubs

The upper set of three dies is stationary, the rivets being headed by the three lower movable dies. Each pair of dies acts independently of the others, although the tonnage is equalized, so that no harm would result to work or press if two rivets or only one rivet were struck.

The equipment is provided with a swing-out arm and mandrel for loading. The rivets are inserted from above with the manufactured head upward. When the swing-out arm is pushed in against a stop, the axis of the assembly to be riveted is accurately located in relation to the dies. The operator then merely rotates the work until a set of three rivets is indexed in line with the dies. Depressing a foot-treadle causes the assembly to be lifted to nest the manufactured heads of the rivets into the upper die cups. 68

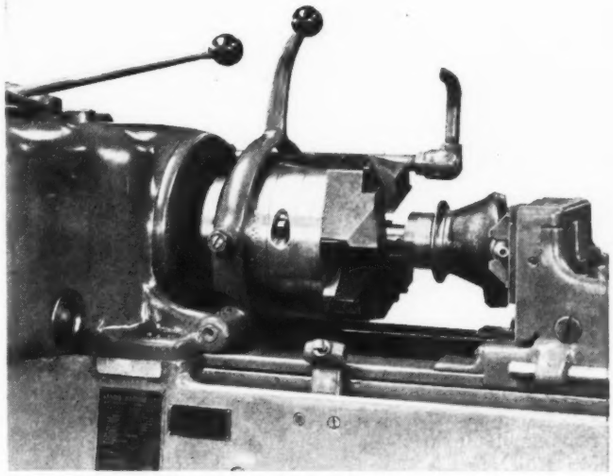
Landmaco Threading Machine for Automobile Steering Pivots

Flexibility is an outstanding feature of a Landmaco threading machine built recently by the Landis Machine Co., Inc., Waynesboro, Pa. This machine is equipped with a special holding fixture and a floating centering mandrel for handling the threading operation on automobile steering pivots.

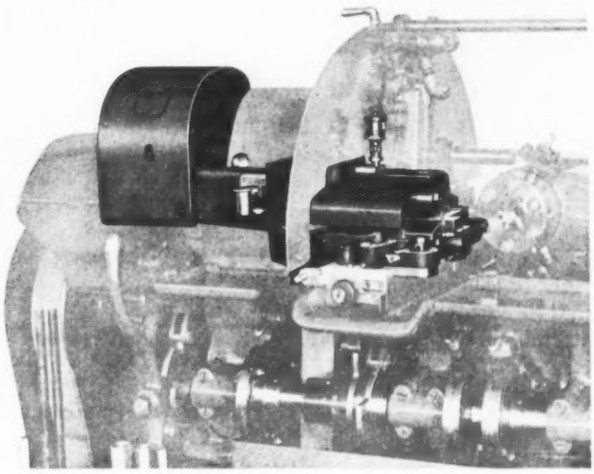
This machine is the standard type equipped with a 1 1/2-inch Lanco heat-treated head. The head is fitted with special over-size chaser-holders for threading the steering pivot, which is 3 1/16 inches in diameter.

A spring-loaded centering mandrel is located within the bore of the die-head and the machine spindle. The end of the mandrel projects beyond the face of the die-head a sufficient distance to engage the steering pivot before the threading operation begins. The mandrel is a close sliding fit within the bore of the pivot, and thus assures concentricity between the bore and the thread. An adjustment is provided at the rear end of the ma-

To obtain additional information on equipment described on this page, see lower part of page 208.



Landis Threading Machine Equipped for Threading Steering Pivots



Brown & Sharpe Thread Chasing Attachment for Automatic Screw Machines

chine spindle to increase or decrease the spring pressure on the mandrel.

The conventional carriage front is replaced by a special holding device which supports the steering pivot in accurate alignment with the axis of rotation. No clamping device is required on the fixture; the pivot is merely supported on the centering mandrel and is driven by lugs which engage the turnbuckles. Both horizontal and vertical adjustment are provided for the holding fixture to assure permanent alignment of the work with the threading head. 69

Thread Chasing Attachments for Brown & Sharpe Automatic Screw Machines

The Brown & Sharpe Mfg. Co., Providence, R. I., has recently brought out thread chasing attachments for use on B & S Nos. 00, 00G, 0, 0G, 2, and 2G high-speed automatic screw machines. These attachments permit the rapid production of accurately formed threads, such as are required on parts for timing mechanisms, electric meters, and similar devices. The attachments can also be used in producing threads at the back of a shoulder on parts that cannot be readily threaded by other methods.

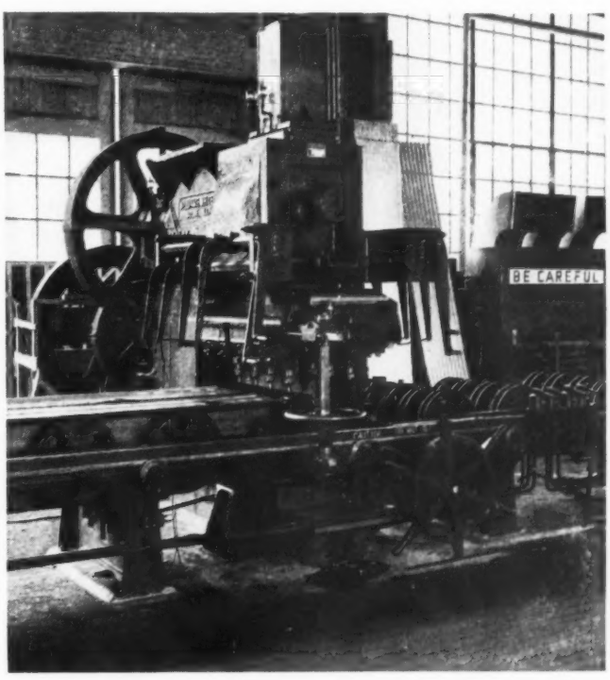
The attachment shaft is gear-driven from the machine spindle, thus assuring perfect synchronization between spindle rotation and operation of the attachment. The chasing tool is carried on a double-slide assembly mounted on the front cross-slide of the machine, and the thread is produced by several passes of the tool along the work, cutting in one direction only. The tool-carrying mechanism operates only while cutting threads.

For any given set-up, the tool moves in a fixed path relative to the cross-line, the movement being governed by a cam driven from the attachment shaft by a worm and wheel. The cam advances the tool to the cutting position and engages a driving shoe on the tool-carrier with the accurately ground threads of the worm or leader on the attachment shaft for feeding the tool along the work. The cam disengages the shoe from the leader to withdraw the tool at the desired point, and a spring quickly returns the tool to its starting position. The front cross-slide cam of the machine advances the cross-slide steadily while the attach-

Williams-White Beam Punch and Spacing Table

A beam punch and spacing table recently built by Williams White & Co., Moline, Ill., is designed for the high production of punched angles and plates. This machine has capacity for handling four angles at one pass ranging from 4 by 4 to 8 by 8 inches.

There are two carriages, one for starting the angles through the tools, and the second for pulling them through to the completion of the operation. The illustration shows a close-up view of the tools and operating mechanism. All the punching tools are gagged so one leg of the angles can be punched by the front tools, and the other by the rear tools. 70



The Tools and Operating Mechanism Provided on the Beam Punch and Spacing Table Built by Williams White & Co.

To obtain additional information on equipment described on this page, see lower part of page 208.

ment is operating to feed the tool into the work. Positive stops on both the cross-slide and the attachment slide assure an accurate depth of cut.

Change-gears provide for cutting threads of the pitches: 13, 14, 16, 18, 20, 24, 28, 32, 36, and 40 threads per inch or leads of 0.5, 0.75, 1.0, 1.5, 2.0, and 2.5 millimeters. The attachment can be arranged to cut either right-hand or left-hand threads, and the spindle can be rotated in both directions. 71

Spot-Welding Gun Equipped with Extension Handle

A unique combination of a light-weight hydraulic spot-welding gun and a light-weight current-carrying extension arm of aluminum has been designed by the Progressive Welder Co., 717 Piquette Ave., Detroit, Mich. This equipment has simplified the problem of spot-welding in many relatively inaccessible locations, such as the four long inside seams on circulator heater cabinets like the one shown in the illustration. The entire length of each seam of one of these cabinets can be easily welded in one continuous operation by applying the welder in the manner shown.

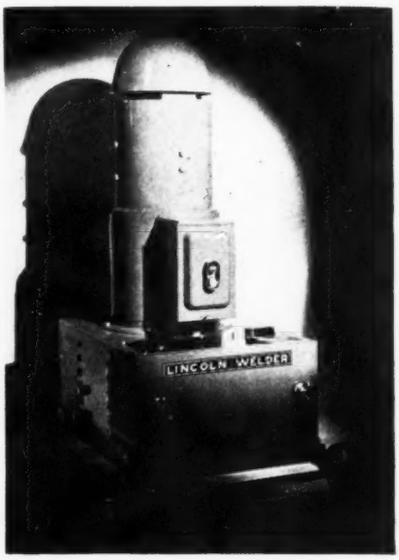
In addition to carrying the welding current, the extension handle of the welder has a hollow section which permits the circulation of water for cooling the gun and the welding points. Hydraulic pressure is supplied to the cylinder of the gun by a flexible hose which runs along the top of the handle. Push-button control in the form of an easily manipulated handle is provided at the operator's end of the unit. 72

Lincoln Junior 200-Ampere Arc Welder

A 200-ampere arc welder of the Lincoln Junior type, which has a range for many welding applications ordinarily associated with considerably larger equipment, has been developed by the Lincoln Electric Co., Cleveland, Ohio. This machine, which is of the motor-generator, direct-current arc type, will weld practically all metals and alloys and do hard facing. It is of the single-operator variable-voltage type, and can be used with either bare or shielded arc electrodes. The current range of this equipment is from 60 to 250 amperes.

A feature for the first time available on small arc-welding machines is the Lincoln patented dual continuous control. This control permits independent adjustment of the voltage and current, giving a complete and separate regulation of the arc heat and arc penetration. Setting of the welder is simplified by the fact that both the voltage and current controls are self-indicating.

Another important feature of this

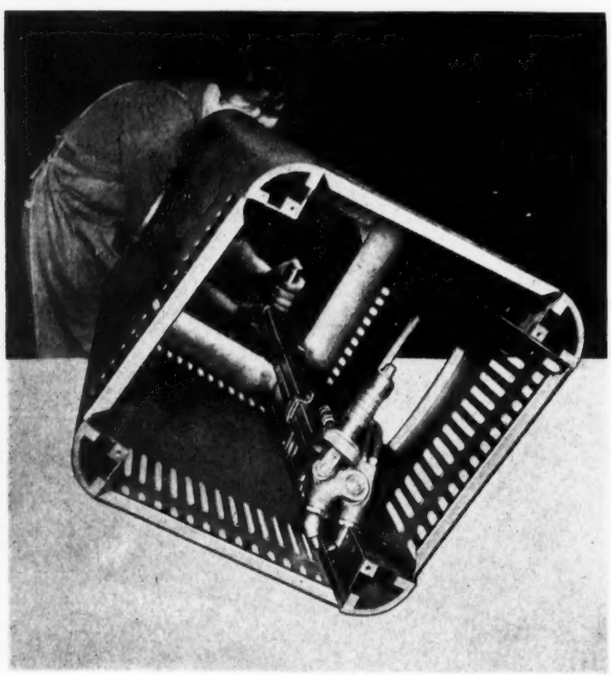


Lincoln Junior 200-ampere Arc Welder

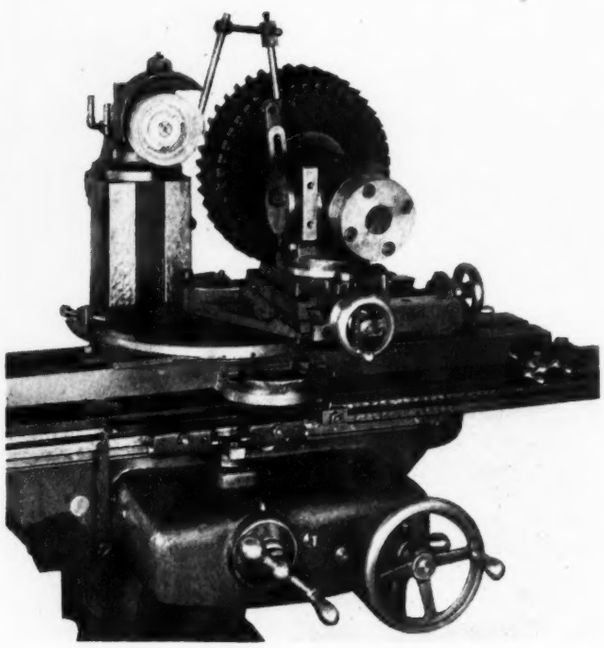
equipment is the fact that the coils are made from glass-covered wire and are mounted in mica-lined slots separated by mica. The end turns are insulated with mica tape, so there are no inflammable materials. 73

Covel Radius Grinding Attachment

Concave and convex surfaces with radii up to 2 inches can be finished by an attachment designed by the



Progressive Spot-welding Gun with Long Extension Arm



Covel Radius Grinding Attachment for Face and End Mills

To obtain additional information on equipment described on this page, see lower part of page 208.

Covel Mfg. Co., Benton Harbor, Mich., for grinding the corner of the teeth on face and end milling cutters. Although this attachment is designed primarily for mounting on the No. 91-A universal cutter and tool grinder of this company's manufacture, it can be used on almost any grinder having a flat-top table from 5 to 6 inches wide, a longitudinal movement of a few inches, and a cup grinding wheel from 3 to 5 inches in diameter.

The face milling cutter is mounted in the spindle of the attachment, and the tooth corner to be ground is lined up in a 90-degree notch in the guide post. The guide post fits in the pivot point of the attachment in a keyed taper hole, and is removed after the cutter is lined up. This method of aligning locates the corner of the cutter to be ground on the exact center of the pivot point. The operator then adjusts two slides to suit the amount of radius required through floating graduated dials reading to 0.001 inch. The spindle is adjustable to give 5 to 7 degrees clearance on the cutter face.

There is also a floating graduated dial for accurate setting of the spindle. For grinding a 90-degree curve on the corner of the cutter teeth, adjustable stops are provided, which limit the swinging motion of the attachment.

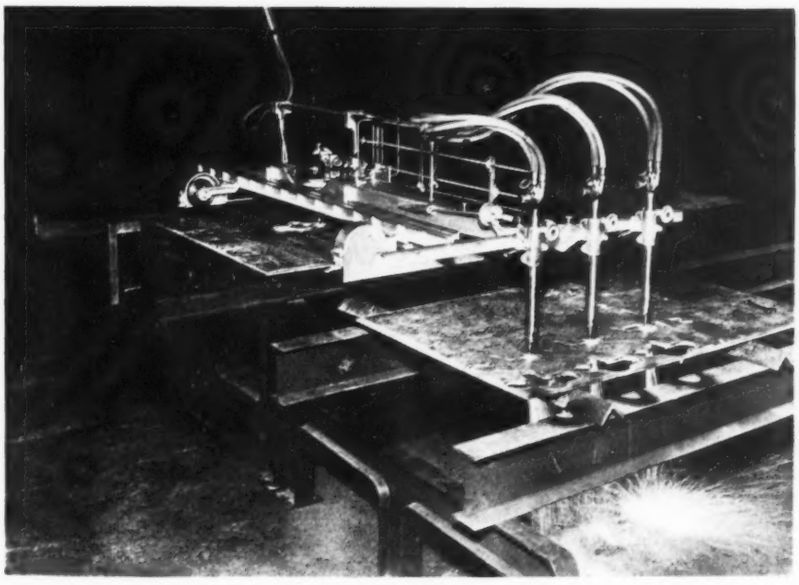
This attachment has a capacity for radius-grinding face mills from 2 to 14 inches in diameter and end-mills with ball-shaped nuts from 5/8 inch to 2 inches in diameter. 74

Linde Oxy-Acetylene Cutting Machine

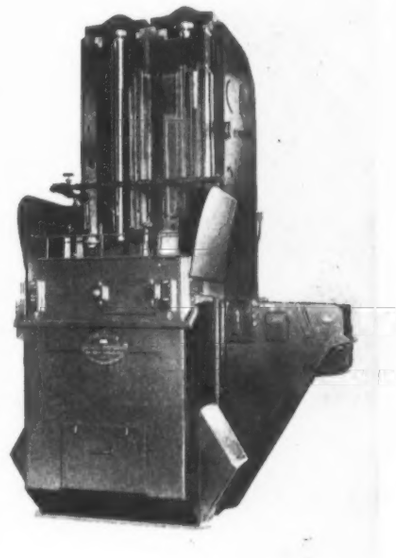
A stationary oxy-acetylene cutting machine that offers unusual possibilities in cutting irregular shapes, rings, circles, and straight-line bevels, and performs several varieties of multiple blowpipe cutting operations in the steel fabrication field has been placed on the market by The Linde Air Products Co., 30 E. 42nd St., New York City. This shape-cutting machine, known as the Oxweld CM-23, has many new operating advantages and refinements, in addition to the fundamental operating conveniences of the Oxweld CM-2 shape-cutting machine which it replaces.

The machine is designed to cut shapes either automatically with templets or guided by hand direct from a full-scale drawing. It is available in two sizes with cutting ranges of 54 and 81 inches in width by 12 feet in length. Circles ranging in diameter from 6 to 49 1/2 inches can be cut on one model. A larger machine will cut circles up to 72 inches in diameter. Both sizes can be extended longitudinally.

When desired, the machine can be built with a transverse capacity of 108 or 135 inches. It will cut steel plate up to 12 inches in thickness. The carriage is driven by a small variable-speed electric motor. Its speed can be varied from 3 1/4 to 48 1/2 inches per minute when templet-tracing, and from 5 1/2 to 82 inches when hand-tracing. 75



New Model Linde Oxy-acetylene Cutting Machine



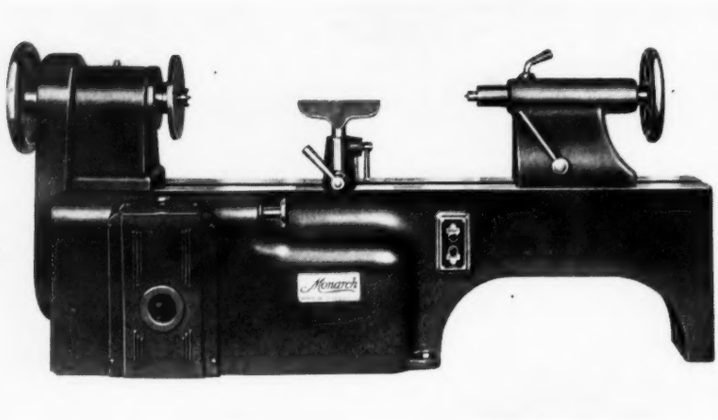
Dual-ram Hydraulic Surface Broaching Machine, Built by the American Broach and Machine Co.

Dual-Ram Surface Broaching Machine

A dual-ram hydraulic surface broaching machine has been built by the American Broach & Machine Co., Ann Arbor, Mich., for the contour broaching of rifle receiver forgings of S A E 3120 steel. This machine is equipped to broach the complete forging on practically all surfaces, four passes of the broaches being required to complete the operation. Dual receding work-tables are alternately indexed by a modified Geneva mechanism, which provides for gradual acceleration to mid-stroke and gradual deceleration from this point to the end of the stroke. Electrical push-button controls, limit switches, and solenoid-operated four-way valves are arranged to give a choice between a fully automatic continuous cycle and a semi-automatic, non-continuous cycle.

The hydraulic pumps, main driving motor, motor starter, and control equipment are housed inside the column, with all adjustable units easily accessible through doors. A motor-driven chip conveyor is furnished to permit sinking the bottom of the machine below the floor level, so as to obtain a convenient loading height. Each cylinder has a normal capacity of 20 tons and a maximum capacity of 28 tons with a stroke length of 66 inches. A 40-H.P. motor is used for the main drive. The weight is about 20 tons. 76

To obtain additional information on equipment described on this page, see lower part of page 208.



Multi-speed Wood-turning Lathe Built by American Saw Mill Machinery Co.

Multi-Speed Wood-Turning Lathes

The American Saw Mill Machinery Co., Hackettstown, N. J., has brought out a new line of wood-turning lathes with positive-drive transmission units capable of an infinite number of speeds from any desired maximum down to zero revolutions per minute. The variable-speed transmission and motor are mounted below the lathe bed, and the spindle is driven by a multiple V-belt from the transmission unit, which is of a type that has been employed for several years on metal-turning lathes. The standard spindle speed range is from 0 to 2400 R.P.M. The spindle speed, indicated by a dial, is controlled by a knurled knob.

The headstock spindle is precision-ground and mounted in two pre-loaded ball bearings which run in an oil bath. All moving parts, with the exception of the faceplate and live center, are totally enclosed. These lathes were originally developed to meet the requirements of the Manual Training Department of the Brooklyn Technical High School, N. Y., where sixty units have already been installed. 77

Geometric Solid Adjustable Die-Head for Small-Diameter Threads

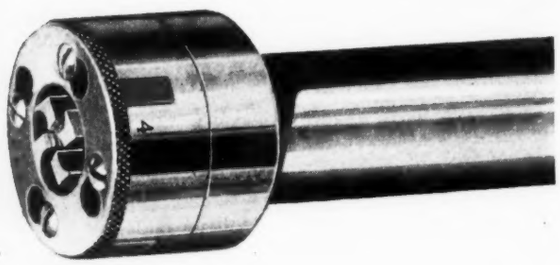
Threads from No. 0 to No. 10 and as fine as 100 per inch can be cut with the EJ5 solid adjustable die-head now being introduced on the market by the Geometric Tool Co., New Haven, Conn. The four chasers are adjustable within the die-head to allow the thread to be produced to the decimal fit desired. The chasers can be quickly removed for resharpening by taking off the faceplate, which is held in place by an application of the bayonet lock principle. Projecting chasers of high-speed steel are furnished as standard to facilitate shoulder threading and to extend the chasers beyond the faceplate for ease in setting.

This die-head is only 1 inch in diameter, and weighs less than 5 ounces, complete with chasers. It is equipped with a non-releasing floating shank to eliminate the need for a separate holder. Thus the tool has a forward floating action that allows for an even start and makes possible the production of accurate threads of small diameter and fine pitch without the use of an accurate camming arrangement. The die-head can be set up on a B & S automatic cammed for solid dies with holders without changing the cams. 78

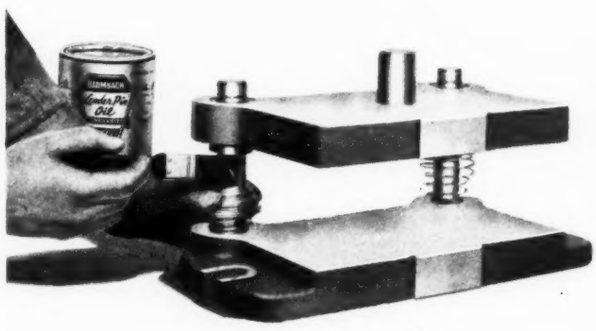
Universal Oiler for Die-Set Leader Pins

The E. A. Baumbach Mfg. Co., 1810 S. Kilbourn Ave., Chicago, Ill., has recently developed an automatic oiling system that is applicable to any make of die set. The oiler consists of two simple units comprising a compression spring and an oil-retaining ring, as shown in the illustration. The oil-retaining ring is made of steel and embodies a high-grade absorbent wick, which fits around the leader pin, riding up and down with the movement of the punch press. The low-tension spring, acting as a booster, lifts the ring to a sufficient height on the up stroke to assure spreading a film of oil on practically the entire length of the leader pin.

Continuous lubrication is obtained by stopping the press, compressing the spring by hand, and swabbing the leader pin with a brushful of oil, which the wick absorbs. The oilers are available in sizes to fit leader pins from 3/4 inch to 3 inches in diameter, with spring lengths of 2 1/2, 4, 6, and 8 inches. 79



Geometric Solid Adjustable Die-head which Cuts from No. 0 to No. 10 Threads as Fine as 100 per Inch



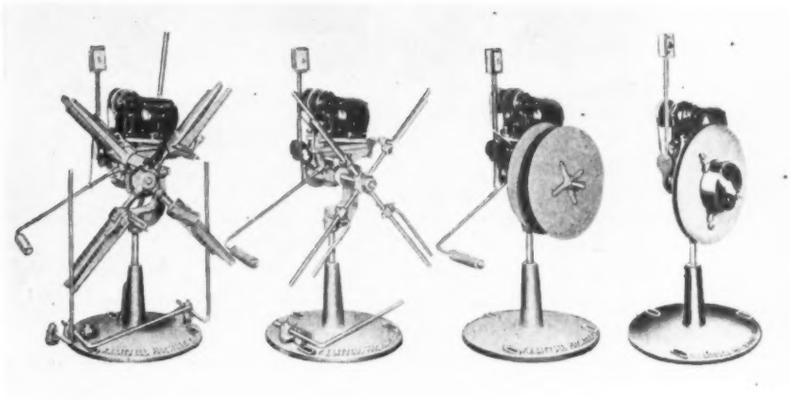
Applying Oil to Die Set Equipped with Universal Oilers Made by the E. A. Baumbach Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 208.

Littell Motor-Driven Reels for Handling Light-Gage Coils

A complete line of light-duty motor-driven reels and winder have been brought out by the F. J. Littell Machine Co., 4149 Ravenswood Ave., Chicago, Ill. These reels are designed to be used with automatic punch presses for carrying light-gage material in coils weighing up to 300 pounds. The reels are available in four different sizes. Starting at the left, the illustration shows an automatic centering reel, a plain reel with arms, a plate type reel, and the scrap winder.

These reels are fitted with adjustable brakes and Mercoid loop controls, and are driven by 1/4-H.P. geared-head motors through V-belts. They can be used for unreeling stock from right to left or left to right by simply switching the loop control arm from one side to the other. The reels can be tilted an any angle, and are adjustable in height. They are fully equipped with anti-friction bearings. 80



Motor-driven Reels for Light-gage Coiled Stock and Scrap Winder, Made by the F. J. Littell Machine Co.

"Wrigraph" Drafting Machine

L. G. Wright, Inc., 5209-41 Euclid Ave., Cleveland, Ohio, has added a Model D-520 "Wrigraph" portable drafting machine to its line of drafting equipment. This new machine is furnished with a special "tack on" mounting plate which permits it to be fastened instantly to any flat wooden surface in any desired position.

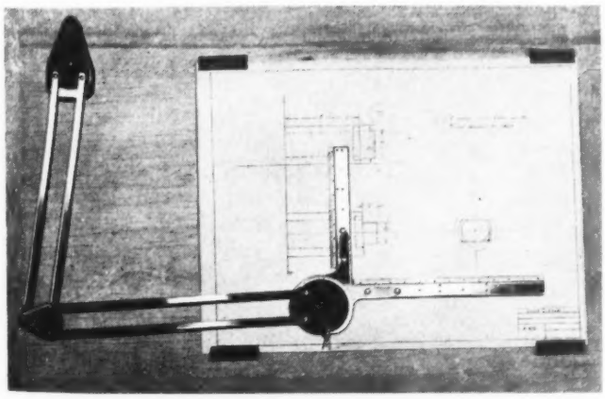
The protractor is of the one-degree indicating type, fitted with a new kind of transparent-edge, accurately graduated scale. Interchangeable scales, with all standard graduations, are available. Although the entire machine can be disassembled and carried in a brief case, it can be used in making drawings 20 by 26 inches in size. Special adjustable ball bearings are said to increase the accurate life of the machine five times. 81

Power-Operated Marking Machine

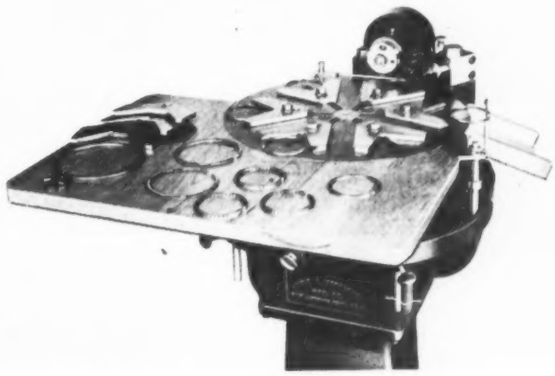
The power-operated, rapid, precision marking machine here illustrated is a recent development of the Noble & Westbrook Mfg. Co., 15 Westbrook St., East Hartford, Conn. This machine was designed to mark inscriptions on the sides of piston-rings ranging up to approximately 5 inches in diameter. The delicate design of these rings makes it necessary that the marking be done with a light uniform impression that will not distort or crack the work.

Sensitive adjustment of the marking die makes it possible to hold its penetration in the ground surface of the ring to a depth of approximately 0.002 inch, or deeper if desired. The marking die revolves continuously, and is timed so that the impression is made in each ring as it passes under the die. The rings are carried to the marking die on a revolving dial. After being marked, the rings are automatically carried into a slide at the side of the machine, which conducts them into a suitable receptacle. The rings are located on the revolving dial by adjustable V-gages.

In order to eliminate any burr or raised portion around the impression produced by the marking die, a burnishing roll is provided which rolls the burr down, so that the piston-rings leave the machine accurate as to size within 0.00025 inch of the original thickness. The production rate is about seventy-five to eighty rings per minute. A 1/4-H.P. motor is required to drive this machine. The weight of the complete machine is approximately 400 pounds. 82



"Wrigraph" Drafting Machine which can be Disassembled and Carried in a Brief Case

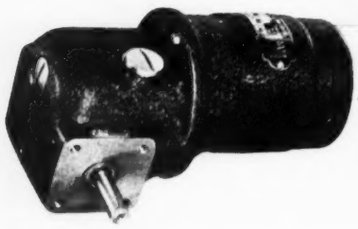


Power-operated Marking Machine Made by Noble & Westbrook Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 208.

Dumore Double-Reduction Geared Motor Unit

The Dumore Co., Racine, Wis., has added a Type KD heavy-duty double-reduction geared motor to its K series units. This new unit has a lower power winding than the other motors in the K series, the output of the armature shaft being approximately 1/10 H.P. at 7000 R.P.M. This motor unit is adapted for operating welding machines, blueprinting machines, transmission controls, stamping machines, and a variety of similar equipment. 83

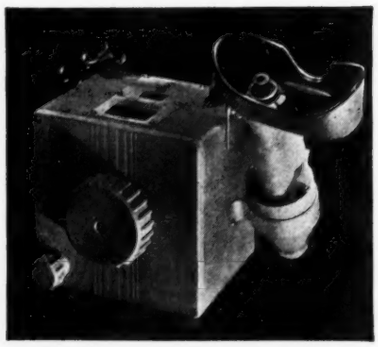


Dumore Double-reduction Geared Motor Unit

Gairing Adjustable "Micro-Nut" for Setting End-Cutting Tools

A device known as an adjustable "Micro-Nut" has been developed by the engineering department of the Gairing Tool Co., Detroit, Mich., for use on either single- or multiple-spindle machine tools. With this device, end-cutting tools can be quickly and accurately set to cut to the correct depth and, in the case of multiple spindles, in proper relation to each other. The device is graduated to permit adjustments ranging from 0.001 to 0.020 inch to be made by means of an adjustable sleeve on a nut that works independently of the screw. The cutting tool can be extended or retracted, and measured adjustments can be made without interfering with the entire tool set-up.

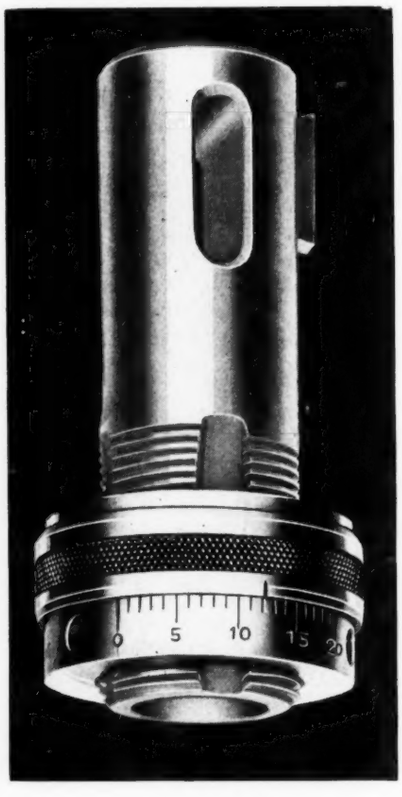
When the cutting tool must be extended or retracted more than 0.020 inch, the required setting is easily and quickly made by loosening the Allen screw in the Micro-Nut and turning the nut on the screw threads to correspond with the approximate estimated movement required. After this adjustment, the screw is tightened and final adjustment is made with the graduated Micro-Nut. 84



Optical Pyrometer Developed by the Leeds & Northrup Co.

Leeds & Northrup Optical Pyrometer

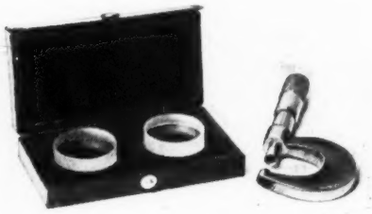
An entirely new temperature measuring instrument, calibrated not in milli-amperes but directly in temperature degrees for greater convenience and accuracy in measuring temperatures, has been brought out by the Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa. This is said to be the first industrial optical pyrometer to use the potentiometer method. It is light in weight, easily operated, ruggedly constructed, and amply accurate for laboratory use. 85



Gairing Adjustable Micro-Nut for Setting End-cutting Tools

Optical Parallels for Checking Micrometer Faces

A set of optical parallels for checking the flatness and parallelism of the faces of micrometers, measuring machines, and instruments by the light wave interference method has been placed on the market by the Van Keuren Co., 12 Copeland St., Watertown, Mass. The set includes two parallels, as shown. The parallels are 1 1/4 inches in diameter, and are accurately flat and parallel within five-millionths of an inch.



Van Keuren Optical Parallels for Checking Micrometer Faces

One parallel is approximately 0.650 inch in thickness, and the other about 0.6375 inch or 0.0125 inch less. The thicker parallel checks the parallelism of the anvil and spindle faces with the spindle in the same angular position as at zero. The thinner parallel checks the parallelism of the two faces after the spindle has been turned one-half revolution or twelve and one-half thousandths from the zero position. Thus, while the anvil and spindle may show perfect parallelism at zero, the other parallel will show any lack of squareness of the spindle face when it is turned one-half revolution from the zero position. 86

Baker Self-Contained Drill Unit

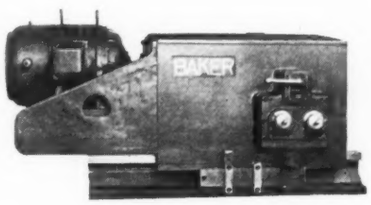
A compact hydraulic-feed drilling unit of new design, embodying the latest features of hydraulic equipment, is being offered to the trade by Baker Bros., Inc., Toledo, Ohio. This unit has been especially designed for easy adjustment of feeding lengths and feeding rates. It is adapted for single-spindle and multiple-spindle drilling, boring, reaming, counterboring, hollow-milling, chamfering, and facing operations.

A variable-delivery pump of entirely new design, which consumes a

To obtain additional information on equipment described on this page, see lower part of page 208.

minimum amount of power for the torque applied, is incorporated in this unit. The standard unit is regularly furnished for two-feed cycle operation. A positive stop and provision for delayed reverse are also available.

The unit is designed to use 3 or 5 H.P., 1200 R.P.M., or 7 1/2 H.P., 1800 R.P.M. motors. The maximum feeding pressure available is 4000 pounds. The maximum head travel is 12 inches, and the distance from



Drilling Unit with Hydraulic Feed, Built by Baker Bros.

the top of the slide to the center line of the driving spindle for multiple heads is 7.250 inches. The size of the flange for application of a multiple head is 13 by 14 inches. The speed range of the main driver for multiple-head application ranges from 400 to 1200 R.P.M. The rapid traverse speed forward is at the rate of 174 inches per minute, and the return speed 232 inches per minute. The speed range of the spindle for single-spindle operations is from 200 to 250 R.P.M. 87

Flat Polishing Attachment

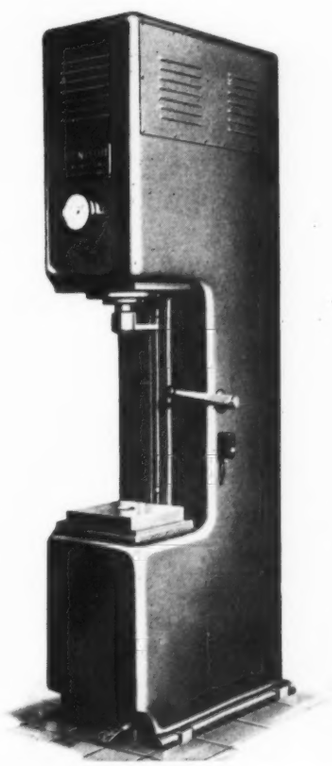
A new attachment for use with an ordinary polishing lathe for grinding, polishing, or buffing flat surfaces has been developed by C. B. Larson, 27 Tuscan Road, Maplewood, N. J. It is preferable that this attachment be used in pairs, so that one operator can keep both spindle ends of the polishing machine at work. In some cases, one operator can attend two polishing lathes equipped with four attachments.

The oscillating spindle is mounted on a balanced floating arm which is adjustable for depth of cut, as well as pressure control. The floating feature of the attachment can be eliminated when grinding with hard wheels. The polishing spindle is driven by a three-groove V-sheave pulley mounted on the original lathe

Flat Polishing Attachment Made by C. B. Larson

spindle. The free end of the lathe spindle extends into the floating-arm support bracket. This bracket is bolted to the lathe pedestal as shown.

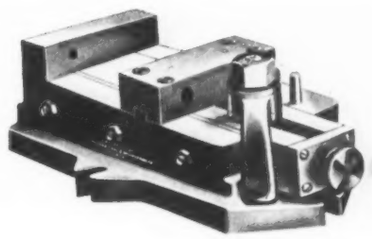
The reciprocating table is mounted on an individual base, and is gear-driven by a 1/4-H.P. motor enclosed in the base. The work-table on which the fixtures are mounted has a leveling adjustment, and attached to it are dust aprons which protect the slides. The stroke of the table is power-driven, a foot-treadle combined with an electric switch starting and stopping the movement, and also automatically lowering and raising the polishing wheel. 88



Denison Hydraulic Press Built in Four Sizes

Production Vise for Milling, Drilling and Grinding Operations

The Chicago Tool & Engineering Co., 8389 S. Chicago Ave., Chicago, Ill., has added a special 2 1/2-inch production vise to its line of Palmgren vises. This new vise is intended for high-production work in connection with milling, drilling, and grinding operations, being especially designed to reduce loading and unloading time. It has an adjustable, quick-acting, cam-locking lever which works against a hardened steel surface.



Production Vise Added to Line of Chicago Tool & Engineering Co.

A hand-screw is provided for quick adjustment when changing to a different-sized piece. Lugs are furnished on the sides of the vise for bolting it to a machine table. Side wear can be taken up by means of adjustable plates. All moving parts are hardened and ground. 89

Denison Hydraulic Broaching, Assembling, and Straightening Presses

The Denison Engineering Co., Chestnut and Water Sts., Columbus, Ohio, has recently developed a vertical hydraulic press designed for assembling, broaching, straightening, and general production press work. The electric-welded steel construction of the frame provides a high degree of strength and rigidity. All corners of the frame are rounded, and ample toe space for the operator is provided, as shown in the illustration. The press is a complete unit, only power connections for the motor and the filling of the oil reservoir being necessary to put it in operation.

With both the foot-pedal and hand-lever released, the press ram rises to the limit of its up stroke, which is determined by adjustment

To obtain additional information on equipment described on this page, see lower part of page 208.

No 000
— HIGH PRODUCTION EFFICIENCY on Small Parts Milling

Automatic Milling Cycle minimizes operating time . . . operator has only to load work . . . press start button . . . unload work after cut

— Only one Dog to set for Table Feed . . . provides rapid setup and permits **extremely short cuts** . . . usually done profitably on Hand Machines only

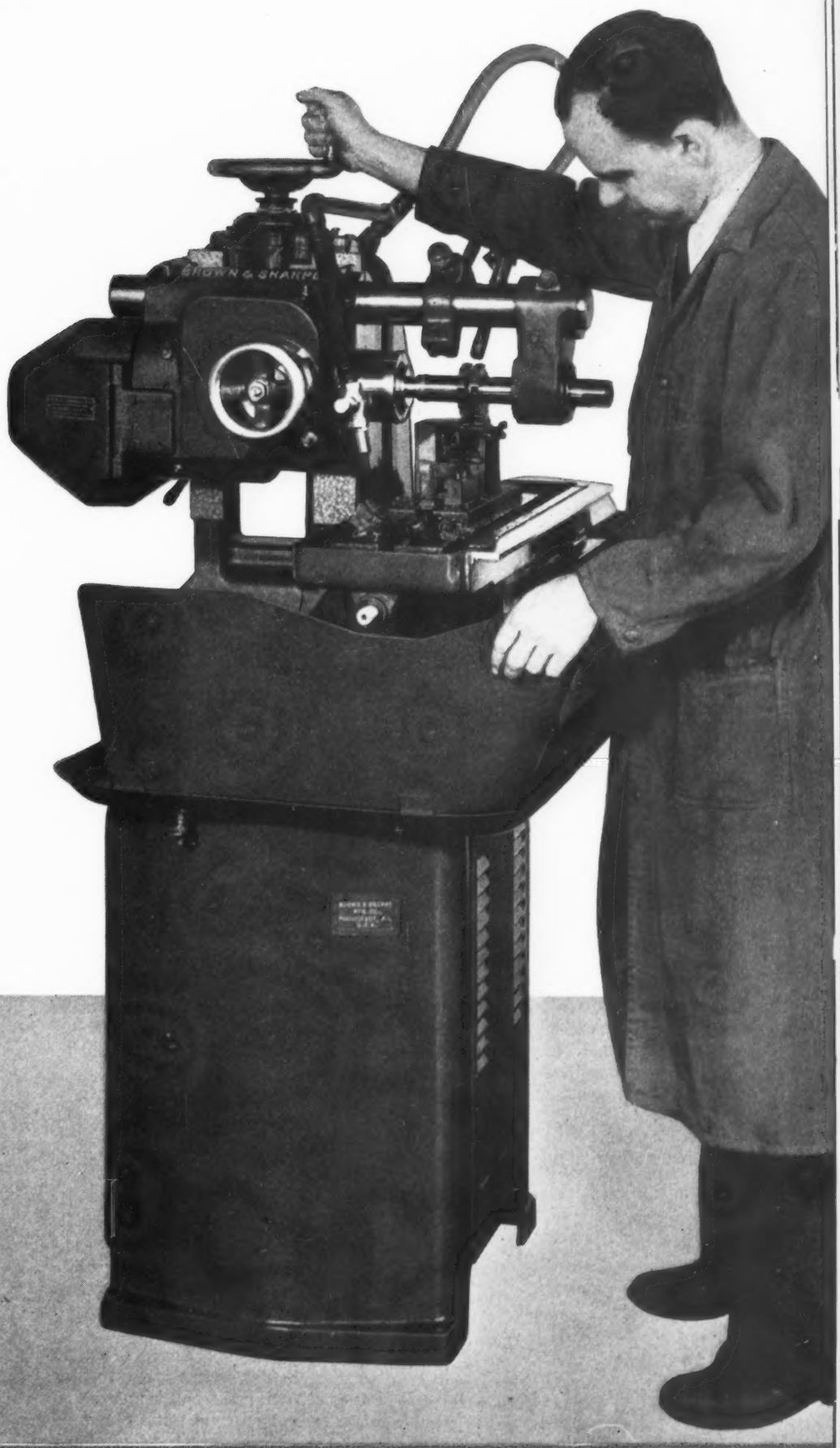
— Accurate Reversal of Table controls length of cut . . . equivalent to using positive stop

B·S

This profitable producer has already established leadership in the field of small parts milling. Investigate the advantages of the No. 000 Plain Milling Machine on your work.

BROWN & SHARPE MFG. CO.
PROVIDENCE, R. I., U. S. A.

BROWN &



Efficient, Simple V-belt Spindle Drive Provides Quick Change of Speed Rate. Direction of Spindle Rotation Selected by Switch. Accurate Transverse and Vertical Adjustments Quickly Made from Front of Machine.

G SHARPE

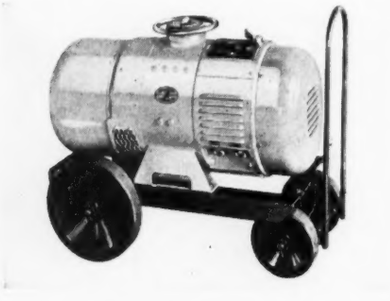
of a collar. The ram then stops, the pressure is released, and the pump and motor run idle. Depressing the foot-pedal or operating the hand-lever causes the ram to move down until it comes in contact with the work with full pressure or, in the case of an assembling operation, until the lower stroke-limit is reached, at which point the ram automatically reverses.

The adjustment for maximum pressure can be made easily by controls, accessible through a door in the rear panel. These presses are available in four sizes having working capacities of 5, 15, 25, and 50 tons. 90

Wilson "Hornet" Electric Arc Welder

A new motor-generator arc welder requiring only one control device for its operation has just been developed by the Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York City. The single control of this welder consists of a handwheel located on top of the unit. Adjustment of this handwheel permits the operator to obtain an infinite number of current settings. Accurately calibrated dial markings eliminate the need for meters.

The single-pole control is said to assure a steady current output that maintains a uniform arc. Accidental reversal of polarity is impossible, the flicking of a small snap switch by the operator being necessary to change the polarity. The motor rotor and generator armature are mounted on a common shaft. Adequate ventilation is furnished by propeller blades attached to the revolving shaft. Although shielded-arc electrodes are recommended, the welder will operate equally well when bare electrodes are used. It is supplied in three sizes rated at 200, 300, and 400 amperes. 91

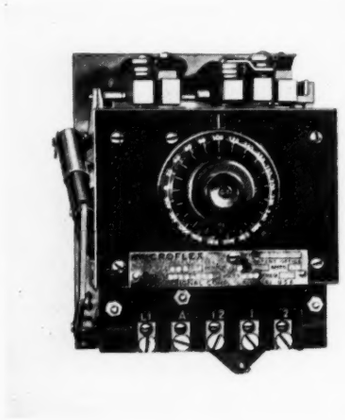


Wilson Single-control Electric Arc Welder

Microflex Reset Counter for Machine Controls

A relay counter, known as the Microflex, for use in limiting the number of operations of a machine or part in a processing cycle has recently been placed on the market by the Eagle Signal Corporation, Moline, Ill. This relay is particularly adapted for use in the control circuits of automatic machine tools and process controls in which a contact is to be closed for a predetermined number of operations.

The counter is fully automatic, requiring only electric impulses to accomplish the counting operation. Dial settings remain fixed through any number of cycles, and need only be reset when the number of operations performed is changed. The standard counters have a counting range of 0 to 400 in steps of 1. 92

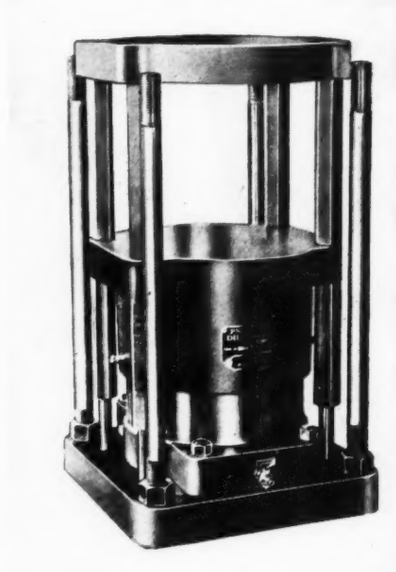


Microflex Relay Counter for Controlling Automatic Machinery

Pneumatic Die Cushion with Slug Clearance

An improved die cushion adapted for a wide range of applications on inclinable and straight-side presses where it is necessary for the slugs, scrap, or blanks to pass through the die proper, including the bolster plate and pin pressure pad, has just been added to the line of the Dayton Rogers Mfg. Co., 2830 S. 13th Ave., Minneapolis, Minn. The new cushion permits the draw-ring pressure pins to pass through the bolster plate and come to rest on top of the pin pressure pad. This construction allows the pin pressure pad to bump against the under side of the bolster plate.

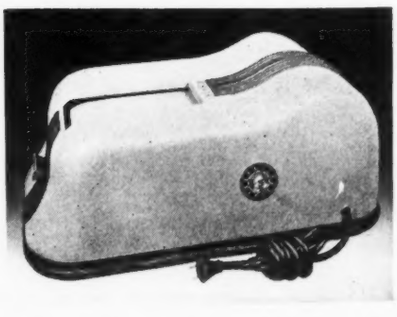
The pin pressure pads can be provided with openings of practically any size for slugs or blank clearance up to the maximum size of the cushion. The openings, of course, allow the slugs, scrap, or blanks to fall through the pin pressure pad so that they clear the top of the die-cushion cylinder. These cushions can also be used to advantage on various compound dies for controlling the action of the stripper plate. They are made in five sizes, from 6 to 14 inches, with drawing capacities ranging from 2 to 6 inches. 93



Dayton Rogers Pneumatic Die Cushion with Slug Clearance

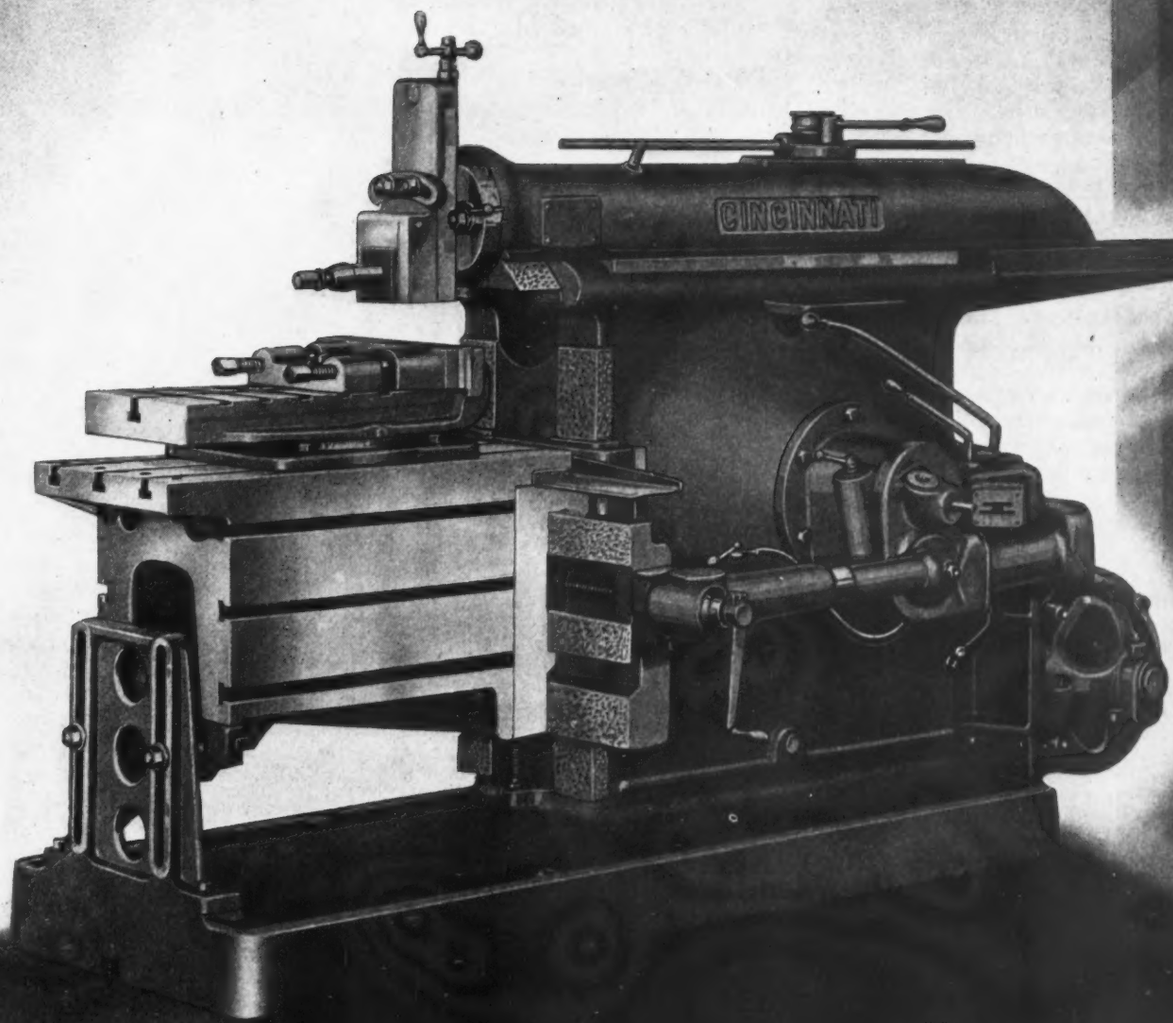
Fisher Belt Grinder for Laboratory Use

A belt grinder of improved design for metallurgical laboratory use has been brought out by the Fisher Scientific Co., 711-723 Forbes St., Pittsburgh, Pa. Grinding belts for rough or fine grinding of metallurgical specimens are employed.



Fisher Belt Grinder for Metallurgical Laboratories

To obtain additional information on equipment described on this page, see lower part of page 208.



Performance counts above everything in mechanical equipment. Quick and accurate shaping of metal is a part of the steady performance of Cincinnati Shapers.

THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

SHAPERS – SHEARS – BRAKES

They are 4 inches wide and are available in five grades of grit.

The revolving belt is supported by a carefully machined surface plate. An open space at the top of the housing allows the operator to press the specimen against the belt without danger of pinching his clothing in the moving parts, which are completely covered. The housing can be lifted away from the base to facilitate cleaning the machine and changing belts. 94

Mellaphone Electronic Rectifier

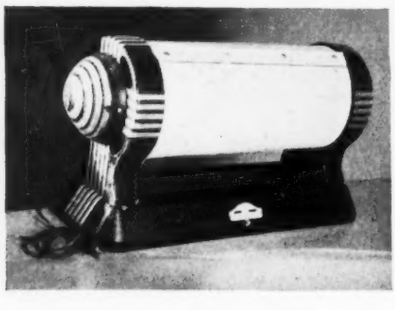
A rectifier that will convert three-phase alternating current into direct current for such applications as driving the variable-speed direct-current motors of grinders and lathes is being produced by the Mellaphone Corporation, Rochester, N. Y. This rectifier operates from a three-phase 220-volt alternating-current line, and has an output of 10 kilowatts at 230 volts direct current.

The voltage remains practically constant, regardless of the load, due to the good voltage regulation of the mercury vapor tubes employed. Installation requires simply the connection of three alternating-current wires and two direct-current wires to the proper terminals, no starting boxes, rheostats, or panel boards being necessary. 95

Paramount Streamline Blueprint Machine

A small machine intended for use in offices and engineering departments for producing blueprints or direct-process prints within one minute or less is being placed on the market by the Paramount Engineering Co., 5707 W. Lake St., Chicago, Ill., under the trade name "Minute Man." This blueprinter is small enough to be placed on a desk, and can be operated by an unskilled person, as it is automatically controlled by an electric timer.

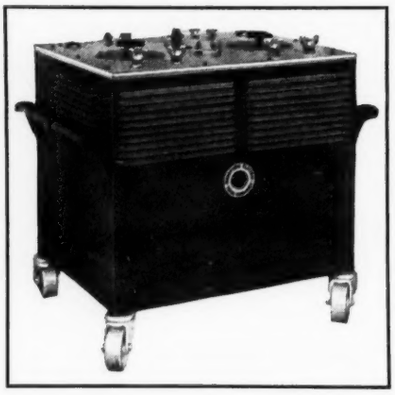
The print paper and tracing are wrapped around a cylinder, 8 inches in diameter by 19 inches long, and are held tightly against the cylinder by a preshrunk cover. Two photo-flood light bulbs mounted horizontally give a uniform light intensity. The machine operates from any standard electric outlet. 96



Blueprint Machine for Rapid Production of Small Prints

Hampton Alternating-Current Welder

The Hampton Electric Tool Co., 700 Walnut St., Edgewood, Pittsburgh, Pa., has recently added to its line of alternating-current welders a new model known as the E2F, which is designed to operate on either 220 or 440 volts. It can be employed by two operators simultaneously, each using from 30 to 280 amperes. By simply shifting a copper bar on top of the welder, it can be operated by one man using from 30 to 560 amperes, with a continuous rating of 500 amperes.

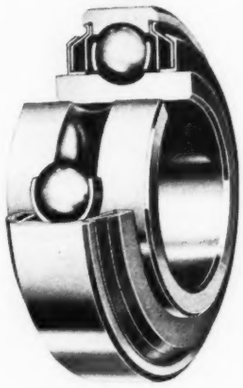


Hampton Welder Designed to Operate on Either 220 or 440 Volts

Electrodes in sizes from 1/16 inch to 1/2 inch in diameter can be used, making it possible to weld the thinnest automobile fenders, as well as the heaviest castings. 97

Fafnir Bearings with New Mechanical Seal

The Fafnir Bearing Co., New Britain, Conn., has made commercially available a new bearing seal design known as "Mechani-Seal" which is claimed to have unusually high sealing efficiency without the disadvantages of any contact material. With this design, there is no tendency for the seal to generate friction or increase bearing wear.



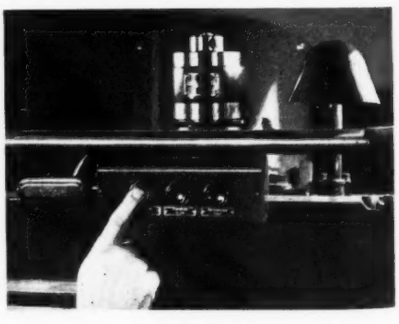
Fafnir Bearing with "Mechani-Seal"

The design has been developed to permit easy assembly and disassembly, the seal being an integral part of the bearing itself, which requires only a simple easily machined housing. This design is now obtainable in single-seal, double-seal, and seal and shield combinations on either the Fafnir radial or wide inner-ring bearings. 98

Power-Controlled Back-Gage for Cincinnati "All Steel" Shear

Increased gaging speeds and fine accurate settings are important advantages claimed for the front-controlled power back-gage which the Cincinnati Shaper Co., Cincinnati, Ohio, is now providing as optional equipment on the "All Steel" shear of this company's manufacture.

The finger-tip push-button control at the front of the shear is conveni-



Power Back-gage for Cincinnati "All Steel" Shear

To obtain additional information on equipment described on this page, see lower part of page 208.

In the New FORD Tool Room

where only efficient precision will do . .

MASTER Super Service RADIALS

In this new tool room, which is one of the largest and finest in the country, two Master Super Service Radials are installed. They are handling the drilling and boring of large automobile body dies with precision and efficiency. This work and similar big jobs such as huge generator housings, turbine casings, Diesel engine frames, and large machine parts, present unusual problems and call for an unusual radial drill. Such work is all within the range and capacity of these new 40 HP. Master Super Service Radials. They are built in sizes from 7′ arm with 22″ diameter column up to the largest size ever built having 12′ arm and 26″ diameter column.

Write for a full description of these remarkable machines.

Left—8′ Master Super Service Radial having 22″ diameter column and special base to permit set-up while drilling.

Below—10′ Master Super Service Radial having 26″ diameter column and special base to permit continuous and simultaneous drilling and layout work.

THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

ently located at the operator's station. Dials reading in inches and sixty-fourths inch or finer are mounted in front above the finger-tip control. A fast forward and a fast backward speed give rapid movement to the desired position. The gage is accurately set by means of a "spotting" button. This gage is especially adapted for work requiring frequent changes in the back-gage setting. 99

Morse Channel-Lubricated Roller Chain

A channel-lubricated roller chain that conforms to American Standard dimensions and is completely interchangeable with all other standard roller chains has been added to

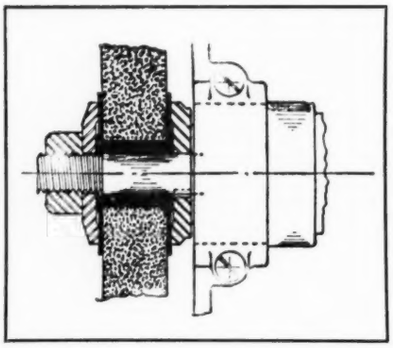
Morse Roller Chain with Channel Lubricating Arrangement

the line of the Morse Chain Co., Ithaca, N. Y. In this round-pin type roller chain, diagonal channels are rolled into the stock from which the chain bushing is formed. When the joint is assembled, these channels appear as spiral grooves and extend through the side plates of the bushing link.

The channels act not only as reservoirs, but also as paths for the flow of oil through the side plates and down to the pins, where the lubricant is spread by capillary action in a protective film over the entire contact surfaces of pins and bushings. In effect, the action is similar to that of small pumps forcing the oil to all wearing parts of the chain. The chain is available in single, double, triple, and quadruple widths, and in all standard pitches. 100

Manhattan Rubber Bushing for Grinding Wheels

A vibration dampener bushing, known as the V.D.B., which is designed to serve as a resilient mounting for portable grinders is a new feature being incorporated in the grinding wheels made by the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., 34 Townsend St., Passaic, N. J. Tests made by the manufacturer have

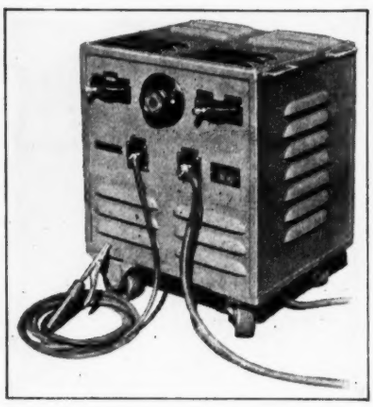


Method of Applying V.D.B. Vibration Dampener Bushing

shown that the use of this mounting, which requires no changes in existing equipment, increases grinding wheel life. Machine maintenance costs are said to be reduced, as well, and a better grinding finish obtained by its use. It is also claimed that the mounting makes possible increased operator efficiency and a minimum of vibration. 101

Allis-Chalmers Low-Current Electronic Arc Welder

The Allis-Chalmers Mfg. Co., Milwaukee, Wis., has brought out a Weld-O-Tron low-current electronic arc welder intended for precision work. This unit can be used to weld with currents as low as 5 amperes through the use of newly developed 1/32- and 3/64-inch electrodes. Steels, stainless steels, and other metals lighter than approximately 18-gage and as thin as 0.010 inch, or approximately 32-gage, can be welded successfully. Thus the equipment is applicable to many types of work previously considered too light for arc welding.

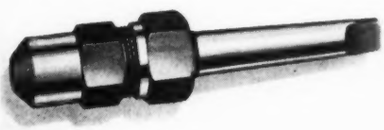


Weld-O-Tron Arc Welder which can be Used on Metal Sheets as Thin as 0.010 Inch

This electronic arc welder is built around a multiple-tube polyphase mercury vapor rectifier unit. The unit combines light weight, long life, and the absence of rotating parts with the advantages of both alternating-current and direct-current arc welding. A handwheel that is provided with an easily read dial permits fine adjustment of the welding current. 102

Erickson Precision Collet Chuck

A new collet type precision chuck for drills, end-mills, etc., which is claimed to have an unusual grip and be extremely easy to set up accurately, even when broken drills are used, is being manufactured by the Erickson Steel Co., E. 80th St. and Bessemer Ave., Cleveland, Ohio. The chuck consists of but four parts, the shank, shank grip nut, collet, and nose-piece. All working faces and the concentricity of holes, bearings, and angles are held to a tolerance of 0.0001 inch. The hexagon shape of the nose-piece facilitates tightening the grip on the drill or tool, as it permits two wrenches to be em-

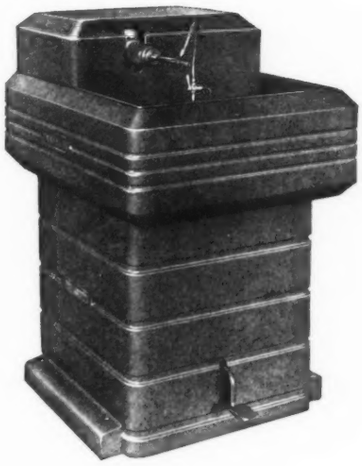


Erickson Precision Collet Chuck for Drills, End-mills, etc.

ployed. The collet will grip firmly and accurately center-drill and end-mill shanks having diameters that vary as much as 1/32 inch. The eight-point grip of the chuck enables it to hold fluted shanks, broken drills, or mills in accurate alignment.

The chuck shank has a deep hole which permits the drill to be set back far enough to prevent vibration. The hardened nose-piece of small diameter permits working close to flanges, grooves, etc., besides giving the operator a clear view of the work. The chucks and parts may be obtained separately or a complete set of Morse taper chucks with collets ranging from 1/2 inch in diameter to No. 80 drill size can be supplied in lock-boxes. Brown & Sharpe or Jarno tapers and parallel shank types will be furnished to order. 103

To obtain additional information on equipment described on this page, see lower part of page 208.



NOW YOU CAN LAP INTERRUPTED HOLES

EX-CELL-O ANNOUNCES a new Internal Lapping Machine, featuring unique mandrel and stone design for fast lapping action and a large area of contact with the work. Holes interrupted by keyways, milled or cored slots, cross holes, etc., are quickly and accurately lapped. The machine is especially adapted to improving the finish and roundness of holes that are difficult or unsuited for other precision finish machining methods such as internal grinding.

You will want complete information on this important new finishing equipment, given in our catalog. Send for a copy, and price, today.

EX-CELL-O CORPORATION DETROIT, MICH.

EX-CELL-O PRECISION MACHINES AND TOOLS

NEWS OF THE INDUSTRY

Illinois and Indiana

CLEARING MACHINE CORPORATION, 6499 W. 65th St., Chicago, Ill., has acquired the INTERNATIONAL MACHINE TOOL CO., INC., Indianapolis, Ind., well-known builder of the Libby turret lathes. The officers are: R. W. Glasner, president; G. A. Pockels, vice-president; H. P. Isham, treasurer; George M. Sundheim, secretary; and B. J. Baldwin, assistant secretary, all of the Clearing Machine Corporation, Chicago, Ill. Edward J. Terry, of the Caterpillar Tractor Co., Peoria, Ill., is also a vice-president.

RICHARD W. YERKES has resigned as secretary-treasurer of the Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill., after a half a century of work for the company. He will continue to serve as a member of the board of directors. HARRY E. KELLOGG, chief accountant, who has been closely associated with Mr. Yerkes for the last eighteen years, will succeed him as treasurer, and F. V. MACARTHUR, formerly assistant secretary, will become secretary.

R. B. MOIR, who resigned recently as chief engineer of the W. A. Jones Foundry & Machine Co., Chicago, Ill., has become associated with Foote Bros. Gear & Machine Corporation, of Chicago, as director of sales research and engineering development.

LEO E. JACOBS, formerly manager of factory sales of Charles H. Besly & Co., 118 N. Clinton St., Chicago, Ill., has been promoted to the position of vice-president of the company.

H. E. ANKENEY has been placed in charge of the Indianapolis territory of Cutler-Hammer, Inc., Milwaukee, Wis., manufacturer of electric motor control equipment. Mr. Ankeney's headquarters will be at 307 N. Pennsylvania Ave., Indianapolis, Ind.

Michigan

AMERICAN CUTTER & ENGINEERING CO., 1453 Fifteenth St., Detroit, Mich., has been organized to engage in the manufacture of high-speed metal-cutting tools. The company is equipped to manufacture all types of milling cutters, reamers, counterbores, forming tools, etc. Complete engineering service is available. The officers of the company are GERALD H. READER, president; ARLO J. HILLYARD, vice-president; MILTON PRICE, secretary-treasurer; and WELDON C. ELLIOTT, in charge of production.

JOHN S. BARNES CORPORATION, 301 S. Water St., Rockford, Ill., announces the opening of a Detroit district sales office at 503 New Center Bldg. ARNOLD J. WERNER, who for several years has looked out for the Barnes hydraulic interests for H. R. Krueger & Co., will have charge of the new office. In addition to supplying Barnes hydraulic pumps, valves, etc., this office will handle the sales of the drilling and boring units, and other self-contained units, manufactured by the W. F. & John Barnes Co.

MARTIN ELECTRIC CO., manufacturer of welding transformers and other welding equipment, has moved to its new plant on Outer Drive, Detroit, Mich. The space formerly occupied in the plant at Piquette Ave. has been taken over by the Progressive Welder Co. and is being used for the expansion of the manufacturing facilities for the latter company's hydraulic and air-operated welding equipment.

SUPER TOOL CO., 21650 Hoover Road, Detroit, Mich., announces the inauguration of a new carbide tool salvage division, providing a service intended for the average user of carbide-tipped tools who has on hand broken, under-size, or obsolete tools too costly to scrap, but of no further use in their present condition.

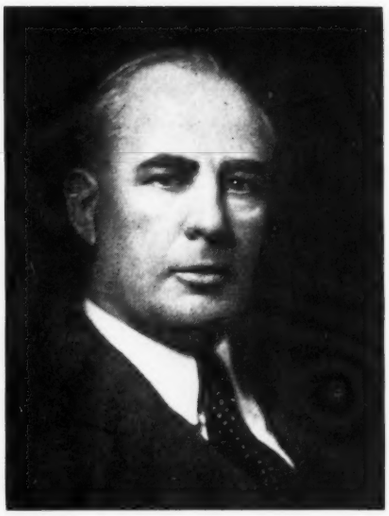
DETROIT BALL BEARING CO., Detroit, Mich., announces the opening of a branch at 115 Ionia Ave., N. W., Grand Rapids, Mich. The company handles Timken, Hyatt, New Departure, Fafnir, and Norma-Hoffmann bearings.

PUTNAM TOOL CO., Detroit, Mich., has recently completed an addition to its plant, which has become necessary in order to meet the increasing demand for Putnam end-mills and other tools.

New England

TAYLOR WINFIELD CORPORATION, Warren, Ohio, has opened a sales office at 623 State Mutual Bldg., 340 Main St., Worcester, Mass., which will handle the sales of the Taylor-Winfield line of resistance welding equipment in the New England territory. V. WAYNE GREEN will have charge of the office.

FRANK A. BALL has retired as president of the L. S. Starrett Co., Athol, Mass., to become chairman of the board of directors. DAVID FINDLAY, formerly first vice-president and general sales manager, has been elected president. ARTHUR H. STARRETT, previously second vice-president, becomes vice-president. WILLIAM J. GREENE, formerly eastern sales manager, has been made general sales manager, and LLOYD I. WILLIAMS,



David Findlay, New President of the L. S. Starrett Co.

who has previously been Pacific Coast representative, has been made Pacific Coast sales manager. In the manufacturing department, R. J. O. SIMPSON retires as superintendent to become consulting engineer, and WILLIAM D. STARRETT, formerly assistant superintendent, has been made superintendent. WILLIAM A. THORP, formerly engineer, becomes assistant superintendent.

GEORGE L. ABBOTT has joined the Graton & Knight Co., Worcester, Mass., manufacturer of leather belting and

George L. Abbott, Vice-president and General Sales Manager of the Graton & Knight Co.

other industrial leather products. Mr. Abbott has become a director of the company, as well as vice-president and general sales manager.

C. W. HEDLER, formerly manager of distributors' sales for the Norma-

SORRY— NO GOOSE GREASE

A COAL-MINE car journal and a skip-drum bearing *both* need lubricating. And neither does well on makeshifts.

A crusher gearbox and a centrifugal pump shaft; a ship's stern tube and a bucket-conveyor tumbler—the list is a yard long and there are also variables in operating conditions and mechanical design which may change lubrication specifications a score of times in one company.

Now—while we don't supply "goose grease," we *do* have scores of different greases in the Shell line. There is a right grease for every lubricating need. It costs no more than the wrong grease and usually costs less.

After all, it is not how much a plant can save on its grease bill; it is the dollars saved on repairs, replacements and shutdowns and the dollars saved on reduced friction which really count.

The services of Shell's lubrication specialists go along with its complete line of greases. This staff, thoroughly trained in solving lubrication problems, is available without charge anywhere in America.

SHELL

SHELL INDUSTRIAL GREASES

Hoffmann Bearings Corporation, Stamford, Conn., and R. L. MILLER, a member of the general sales staff, have been made assistant sales managers. WESLEY G. SARGENT, mechanical engineer formerly with the Frick-Reid Supply Co., of Pittsburgh, Pa., has been appointed assistant to Mr. Hedler, who will continue to be in charge of distributors' sales.

C. E. H. PALMER, of the Newark, N. J., office of the General Electric Co., has been appointed manager of the company's New Haven office.

New York

GANO DUNN, president of the J. G. White Engineering Corporation and of Cooper Union, New York, has been chosen as the recipient of the Hoover Medal for 1939, awarded by engineers to a fellow engineer for distinguished public service. The medal will be presented to Mr. Dunn under the auspices of the American Institute of Electrical Engineers during the annual convention of the Institute in New York City, January 22 to 26. The achievements for which Mr. Dunn was honored cover more than a quarter of a century of service to the government, to science and engineering, to education, to civic betterment, and to international organization.

WILLARD A. TERRY, for several years associated with the welding section of the Industrial Department of the General Electric Co., Schenectady, N. Y., has been assigned to new duties in the company's Philadelphia office. In his new position, Mr. Terry will have charge of electric welding sales along the Atlantic seaboard, including the heavy industrial centers of Philadelphia, Norfolk, and Pittsburgh. C. I. MACGUFFIE, arc-welding specialist in the company's Atlantic district, will take over Mr. Terry's duties in the Industrial Department at Schenectady.

ALEXANDER G. CHRISTIE, president of the American Society of Mechanical Engineers, and professor of mechanical engineering at Johns Hopkins University, Baltimore, Md., and Henry Ford, of the Ford Motor Co., Detroit, Mich., have been awarded honorary life membership in the Institution of Mechanical Engineers, of Great Britain. This is the highest honor that can be given to a living engineer by the Institution, and is held by only one other American, Alex Dow, president of the Detroit Edison Co., Detroit, Mich.

D. J. REESE and D. M. CURRY, of the Development and Research Division of the International Nickel Co., Inc., 67 Wall St., New York City, presented addresses at the Baltimore-Washington Regional Conference of the American Foundrymen's Association on October 20, at the Lord Baltimore Hotel, Baltimore, Md.

OLIVER C. SPURLING, for thirty years in charge of the design and construction of factories here and abroad for the Western Electric Co., 195 Broadway, New York City, retired on September 30 at the end of a forty-six-year career. He is succeeded by HENRY L. WARD, assistant to Mr. Spurling since 1935.

A. G. ZIMA, west coast representative of the Development and Research Division of the International Nickel Co., Inc., 67 Wall St., New York City, presented an address on nickel alloy steels before the Oregon Chapter of the American Society for Metals on October 12 in Portland, Ore.

SHEPARD NILES CRANE & HOIST CORPORATION, Montour Falls, N. Y., has appointed the STONE RYALS ELECTRIC & MFG. CO. representative of the company in the San Francisco, Calif., district, and PRESTON FALLER representative in the Seattle, Wash., district.

Ohio

JOHN C. DABNEY has been appointed sales manager of the Seybold Division of the Harris-Seybold-Potter Co., Cleveland, Ohio. The Seybold factory, located at Dayton, Ohio, manufactures equipment for printers and bookbinders, and also makes a wire stitching machine for sheet metal. Mr. Dabney was vice-president and sales manager of a company engaged in the manufacture and distribution of structural steel and steel specialty products until he joined the Harris-Seybold-Potter organization in May, this year.

FRANCIS G. COLLURA of Cleveland, Ohio, has been appointed eastern design director for Designers for Industry, Inc., 630 Fifth Ave., New York City.

Pennsylvania and New Jersey

G. O. HOGLAND, of the Aluminum Co. of America, New Kensington, Pa., and G. S. BERNARD, JR., of the Aluminum Cooking Utensil Co., also of New Kensington, were awarded the Lincoln Gold Medal at the annual convention of the American Welding Society in Chicago, Ill., on October 23. This award is presented each year by James F. Lincoln, of Cleveland, Ohio, for the paper considered the greatest original contribution to the advancement and use of welding. The paper by Mr. Hogland and Mr. Bernard that won the award this year was entitled "The Effect of Current, Pressure, and Time on the Shear Strength and Structure of Spot-Welds in the Aluminum Alloys."

C. J. HOLSLAG, president, general manager, and chief engineer of the Electric Arc Cutting and Welding Co., Newark, N. J., was awarded the Miller Medal at the annual meeting of the American Welding Society in Chicago, Ill., on October 23. The award is made annually by the Society for a "conspicuous contribution to the advancement of welding or cutting of metals."

OBITUARY

JOHN MILLER, JR., general superintendent of Charles H. Besly & Co., Chicago, Ill., died on August 20 at the Michael Reese Hospital in Chicago. Starting as an apprentice at the Beloit Works almost fifty years ago, Mr. Miller rose through the ranks of the factory organization until he became general superintendent. He will be succeeded by Ralph Walter Young, who has held the position of head of the Besly Grinder Division for the last fifteen years.

COMING EVENTS

NOVEMBER 1-3—Annual meeting of the MEEHANITE RESEARCH INSTITUTE OF AMERICA, INC., at the Hotel Statler, Detroit, Mich. Headquarters of the Institute, 311 Ross St., Pittsburgh, Pa.

NOVEMBER 3-4—NATIONAL MOTION AND TIME STUDY CLINIC to be held at the Medinah Club, Chicago, Ill., under the auspices of the Industrial Management Society, 205 W. Wacker Drive, Chicago.

DECEMBER 4-8—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Bellevue-Stratford Hotel, Philadelphia, Pa. C. E. Davies, secretary, 29 W. 39th St., New York City.

DECEMBER 4-9—Seventeenth EXPOSITION OF CHEMICAL INDUSTRIES in the Grand Central Palace, New York City. For further information, apply to Charles F. Roth, president of the International Exposition Co., Grand Central Palace, New York City.

DECEMBER 9—EASTERN PHOTOELASTICITY CONFERENCE at Cambridge, Mass., under the auspices of the Massachusetts Institute of Technology. Address inquiries to W. M. Murray, Room 1-321, Massachusetts Institute of Technology, Cambridge, Mass.

JANUARY 15-19, 1940—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Book-Cadillac Hotel, Detroit, Mich. John A. C. Warner, secretary and general manager, 29 W. 39th St., New York City.